1-1-1987

Building mathematics and computer confidence among elementary teachers : case studies of staff development in schools serving minority students.

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BUILDING MATHEMATICS AND COMPUTER CONFIDENCE AMONG ELEMENTARY TEACHERS: CASE STUDIES OF STAFF DEVELOPMENT IN SCHOOLS SERVING MINORITY STUDENTS

A Dissertation Presented

By

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Submitted to the Graduate School of the
University of Massachusetts in partial fulfillment
of the requirements for the degree of

DOCTOR OF EDUCATION

May 1987

Education

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DEDICATION

This work is dedicated with love to:

My husband, Eugene, whose quiet support helped me through very rough times.

My children, Kevin and Kara, for their encouragement and their willingness to allow me to draw upon family time and resources and for their understanding why this work was necessary.

My mother, Sarah, whose desire for an education gave me the inspiration to continue on.

and

In memory of my aunt, Bridget.

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Acknowledgements

I wish to express my deepest appreciation to all the people who have made this dissertation a reality. To Dr. Byrd L. Jones, for his support, friendship, and his assistance in helping me to connect theory to practice. To Dr. Portia C. Elliott, for guiding me during stimulating discussions as well as her patient and knowing support in the area of mathematics. To Dr. Jon L. Sicks, for his many insights concerning using computers in the schools and his cooperation, knowledge and understanding. To Dr. William Fanslow, who gave me confidence, encouragement and support.

I wish also to express my gratitude to Bryant Robinson, Deputy Superintendent, and Ann Southworth, Assistant Superintendent of Instruction and Staff Development, who gave me permission to do this study in two Springfield public elementary schools. And finally I wish to thank the principals and participants of the DeBerry and Brightwood Elementary Schools for their dedication and professionalism.

Abstract

Building Mathematics And Computer Confidence
Among Elementary Teachers:
Case Studies Of Staff Development In Schools Serving
Minority Students

May 1987

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Elementary schools face an urgent need for effective staff development to encourage computer utilization and provide appropriate mathematics activities. This dissertation describes staff development work sessions for utilizing computers and developing mathematics activities in two urban elementary schools.

This document describes the process, the activities and the curriculum materials developed, and

suggests pedagogical strategies for using computers with students specifically in mathematics. The process strives to create an environment in which staff members share in planning and implementing activities designed to generate motivation and enhance learning for all students.

In keeping with action research approaches, this effort was informed by previous studies of staff development and implementing school change. Also, as the study proceeded, mid-course corrections kept to the initial goal of responding to teacher-generated needs. The activities engaged in this study involve teachers' identifying needs based on perceptions, prioritizing these needs, and then devising and implementing an action plan.

As a result of the staff development activities conducted, participants conducted mathematics and computer activities with their students. These activities were found to have a positive effect on a) stimulating motivation, b) encouraging peer interaction, c) providing individualized instruction, and d) enhancing student learning.

Based on the experiences and insights gained from the planning procedures engaged in this study, the following conclusions were supported: a) staff development needs overlapped therefore, school based workshops were feasible, b) teacher involvement in establishing objectives for the proposed staff development activities is important for shared ownership, c) when scheduled work sessions were longer than a month apart reviewing learning hindered progress, d) hands-on experiences and practice over a period of time is crucial for reinforcing adult learning, e) hand-out materials helped teachers to apply learned ideas in their classrooms, f) teachers discovered that successful change depends on their own efforts, and g) teachers at each school could be trusted to implement change efforts.

The study concluded that teachers working together, using the resources available, empowered themselves by identifying and prioritizing needs and then developing an action plan which met the objectives of the district's curriculum and operated in a coherent framework with a sound understanding of computer and mathematics education.

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Chapter I

Introduction

This study reports on the effect of teacher involvement in the planning and implementing of staff development work sessions specifically in computer utilization and appropriate mathematics activites for use at the elementary school level. Based on the results of a needs assessment survey, completed by participants from two urban elementary schools, work sessions were formulated. These work sessions aimed to build mathematics and computer confidences and to reduce mathematics and computer anxieties in teachers and students.

This study documented the process followed, the activities and the curriculum materials developed and suggested pedagogical strategies for using computers with students--specifically in mathematics. The activities developed met the needs of minority and female students as well as all students in an urban school system. The process strove to create an environment in which principals, teachers, resource personnel and students shared in learning, planning and decision making. Revitalizing existing staff

development activities for elementary school teachers by integrating computers into the mathematics staff development program was necessary in order to achieve the objectives of this study.

A 1985 Johns Hopkins survey conducted by Becker showed over one million computers in the nation's primary and secondary schools with this number almost doubling every year. However, with this multitude of computers one should not infer that computers are used appropriately or equitably. Computer usage will be determined by the equipment available at the school and by the teachers' confidence to use the equipment.

The problems faced in planning and implementing staff development for computer utilization are embedded within a larger set of problems associated with introducing school change. The two urban elementary schools involved in this study faced the issue of a mainframe system with hardware and software purchased mainly for drill and practice use. The task facing this group of teachers was to create a staff development program for computer utilization beyond drill and practice in the context of school change. This required significant changes in the regularities of the two schools. Consequently, it required a good deal of

inservice efforts and open communication on the part of the staff members to make full use of the potential of the computers.

The undertakings chronicled in this dissertation describes the researcher's efforts to involve staff members in the planning and implementing of a school-based staff development program to generate change that can be translated into more effective utilization of computers, appropriate mathematics activities and an equitable education for all students.

Context of the Study

Sarason (1982) maintained that "those who attempt to introduce a change rarely, if ever, begin the process by being clear as to where the teachers are, that is, how and why they think as they do" (p. 195). Those who plan to support teachers in a change process must understand and acknowledge key forces which may militate against an easy acceptance of change strategies. Effective staff development must acknowledge the realities of teachers' attitudes and needs. Teachers today are active learners continuously adapting to changing school and individual student needs.

As researchers from the Rand Study pointed out for many teachers:

> Passage of time on the job seemed to diminish their capacity to change and to dampen their enthusiasm for innovation and for teaching. This 'calcifying' effect seemed less an intrinsic characteristic of teachers than testimony to the way schools are managed and the way professional development activities are provided for staff. (McLaughlin & Marsh, 1978, p. 84)

In the Rand study, the innovative projects that made a lasting difference in schools emphasized concrete, teacher-specified, extended inservice education (Berman & McLaughlin, 1978). Yet most inservice training fell far short of those goals. According to Wood & Thompson (1980):

> Most staff development programs are irrelevant and ineffective, a waste of time and money. Disjointed workshops and courses focus on information dissemination rather than stressing the use of information or appropriate practice in the classroom. Seldom are these programs part of a comprehensive plan to achieve goals set by the school staff. (p. 374)

Training for Elementary School Teachers

Educators share a growing concern about the elementary school teachers' lack of mathematics and computer experience (Campbell, 1983, 1986). Changes in mathematics education have been extensive since the Sputnik era. Curriculum revision, accelerated research,

automation and concern on the part of mathematicians, scientists, psychologists, and educators have brought about an influx in workshops, inservice education, and staff development programs.

The so-called "Computer Age" has now become an integral part of our scientific and technological culture. A wider and keener interest in mathematics must be developed among our youths, not only to prepare them to survive in our complex society, but also to prepare more of them for expanding positions requiring scientific and technical skills. The acceptance of new mathematics programs in our school raises the problem of providing for the training of our teachers on an ongoing basis--a staff development program based on teacher involvement in its planning, implemention, and evaluation.

Elementary teachers must know as much as possible about how children learn, about creating environments most conducive to learning, and about techniques and methods offering the best opportunities for learning. These are all important factors in the teaching of a child, but there must also be something to teach; that element called content. Teachers of elementary school mathematics need a unique type of preparation with

courses that are relevant to the concepts and materials they will be expected to use in the classroom (Riedesel, 1980). Studies conducted by Edneier and Good (1979), Meyer (1980), and Tishler (1980) emphasized the importance of proper inservice education in the elementary schools. These researchers found that attitudes toward mathematics could be improved through inservice mathematics training.

Since 1978, much attention has been paid to the negative effects of mathematics anxiety and computer anxiety (Campbell, 1986; Kogelman and Warren, 1978, Tobias, 1978). Considerable emphasis has also been placed on generating, and/or creating, equitable instructional environments for all students. This dissertation describes an environment in which principals, teachers, resource personnel, and students share in planning, decision making and learning activities designed to generate motivation and enhance learning for students, especially minority and female students.

An attempt was made by the researcher to develop positive attitudes toward mathematics and computer utilization, as well as to foster equity in mathematics and computer utilization in elementary school teachers

who work with a large number of minority and female students.

Statement of Problem

Current research cites the importance of school-based staff development that is related to staff identified concerns and that utilizes teachers as the initiators and implementors of change efforts. The need for better inservice training for the elementary school teacher in the area of mathematics and computer utilization necessitates devising ways to work within the objectives of the district's curriculum and encourage and facilitate computer use by providing assistance and support for all staff members. Operating in a coherent framework with a sound understanding of mathematics and computer education should build staff confidence in these areas and facilitate more computer utilization; however, there is no formula nor preplanned strategy to follow to achieve results. This author's study seeks ways to collaboratively plan and implement changes that can be translated into more computer utilization, appropriate mathematics activities and more equitable education for all students.

Rationale of Study

This project is based on six assumptions:

1. That providing school personnel with the support and encouragement to become involved in effective inservice programs must begin by acknowledging the realities of teachers' attitudes and needs (Sarason, 1982).

2. That teachers can discover that much of the expertise for successful school change can be legitimated and found among teachers, themselves (McLaughlin & March, 1978).

3. That small group interaction among teachers is very beneficial for teacher support concerning day-to-day changes which occur within their school (Lieberman & Miller, 1984).

4. That teachers who understand how and when to use computers to augment existing educational procedures are the key to creative and effective use of computers (Campbell, 1983).

5. That elementary school teachers may have some anxiety about their own ability in the areas of mathematics and computer education (Tobias, 1978).

6. That motivation of students could be increased by an environment that encourages active learning experiences (Ragosta, Holland & Jamison, 1982).

The first assumption suggests that staff development activities should be school-based and linked to classroom application. Changes must involve teachers as active participants continuously adapting to changing school and individual needs. The second, assumes that a primary motivation for teachers to take on extra

work and other personal costs of attempting change is the belief that they will become better teachers and that their students will benefit. Third, that staff development activities should involve as many teachers from a single school as possible in order to provide a support group for the teachers who are motivated to implement change.

Fourth, elementary school teachers need a unique type of preparation with preservice and inservice activities that are relevant to the concepts and materials they will be expected to use in their classroom. As teachers' understanding of mathematics and computer instruction increases, self-confidence increases, and often, this leads to greater ease in teaching. The fifth assumption holds promise that inservice education in mathematics and computer applications are issues our schools must face if elementary school teachers are to instruct their students in these areas. And, sixth, teachers should explore how computers can be used to motivate students, specifically minority and female students. Research has shown that low achieving students who are taught with computers gain positive attitudes toward computers

as well as positive attitudes toward the subject matter (Ragosta, Holland & Jamison, 1982).

Research Question

The study will answer a set of central questions, i.e., a main question and a group of subsidiary questions. These are the central questions:

Main Question

What are the planning processes and procedures that enable teachers and other staff members to work together to plan and implement a staff development program in computer instruction and mathematics instruction appropriate to their own individual needs and the needs of their students?

Subsidiary Questions

1. How do the principal, teachers, resource personnel, paraprofessionals, and students work together to develop meaningful computer experiences for all users?
2. Are there factors in the school culture that inhibit or enhance the working relationships of the aforementioned?
3. How do teachers build their own familiarity with computers in an effort to use computers effectively as a tool in the teaching process?
4. What do teachers do to ensure equity of computer instruction for all students?

5. How can teachers motivate their students--especially minority and female students--to use computers and enhance student learning?

Methodology of Study

The activities conducted in the study were formed by two doctrines of action research. One of these involved examining the past research of others. This project incorporated as many research-tested features as possible. The other involved gathering data and examining this data in an effort to direct the process of future decisions for staff development.

The activities revolved around the planning and implementing of a staff development program designed with the input of staff members to bring about the desired outcomes. The planning activities engaged in this study involved teachers' identifying needs based on perceptions, prioritizing these needs, and then, devising and implementing an action plan. This process, thus defined, served as an underpinning for the theories which guided the procedures engaged in this author's study.

The process maintains a particular focus on minority and female students. In recent years, much attention has focused on female and minority students' lack of mathematical ability and computer exposure.

The entire issue of The Journal for Research in Mathematics Education, March 1984, was devoted to minorities and mathematics. A special issue of Phi Delta Kappan, March 1986, focused on females and mathematics. The March 1986 issue of Educational Research also gave special attention to females and mathematics. In addition, the April, 1984 issue of The Computing Teacher dealt with computers, females, and minority students.

While the staff development projects engaged the total school population, evaluation of the objective developed and implemented with each staff depend on achieving these objectives specifically for minority and female students. The nature of the process was shaped in an ongoing fashion in response to the outcomes of meeting, dialogue, needs assessment and feedback assessment data. The processes of more computer usage and improving mathematics activities focused on establishing appropriate instruction for minority, female and for all students via a consensus of the various groups working together within the two schools. The staff development aspect focused on principals, teachers, paraprofessionals and resource personnel. The documentation of this process served to chronicle a

staff development project which actively involved staff in the planning and implementing stages of change efforts, specifically by providing a forum for all to be involved actively.

Evaluation of the objectives set forth for the staff development activities made use of a formative evaluation process. Keeping logs; of meetings at each school, needs assessment, and feedback assessment for each school guided the process carried out at each school. Anecdotal notes and interviews were also documented.

Inservice training was provided to staff members at each school based on the prioritized needs of each teacher at each school. Feedback assessment was administered to each participant following each staff development session to glean opinions, to determine the effectiveness of the activities, to identify new areas of concern, and to appraise the degree of satisfaction of the participants. The feedback assessment served to establish the agenda for the next staff development activity. Each staff development session offered teachers hands-on activities for learning and suggested direct ways in which students and teachers, teacher and teacher, could work together.

Sarason (1982) suggested that effective change cannot take place without examining the behaviors and regularities of each setting. This document focused on teachers actively involved in their own staff development. Activities developed in this project were hands-on, using computers, and suggested direct ways in which students and teachers could interact. The major focus of this staff development project is to generate change that could be translated into more computer instruction and appropriate mathematics activities for all students in the urban school setting.

School Setting

This staff development effort was shaped by the history, climate, and resource personnel of the Springfield schools. Springfield, Massachusetts is a medium sized city situated in the Connecticut River Valley with a population of 155,000. The Springfield Public School System is composed of 22,677 students. Of this population, 55.7 percent are minority, and a little under half of the total population is female 47.8 percent.

The school population in the city of Springfield is changing with an increased number of minority

students (See Appendix I-1). In September, 1986, Black students represented 27.9 percent of the school population of 22,677, while Hispanic students represented 26.8 percent. Tables 2 and 3 provide demographics relevant to this study (See Appendix I). Tables 1, 2, and 3 were made available by the Research Department of the Springfield Public Schools. The selection of two schools for the study was accomplished with the assistance of the Deputy Superintendent. The schools selected were Brightwood and DeBerry. The identification of the DeBerry Elementary School and the Brightwood Elementary School was based on the following common factors: a) equal grade structures; b) similar programs in size, curricula and organization; c) availability of Chapter I and city 636 computers; d) 636 resource teachers at each site; a Chapter 636 teacher is a teacher funded by the state for integration purposes; e) high minority population; f) very little previous staff development in computer or mathematics for teachers at these schools; and g) implementation of a Chapter I computer program at each school.

William N. DeBerry School

The William N. DeBerry Elementary School is located in the Winchester Square section of Springfield. The staff members at this school consist of a female principal, twenty-five female teachers, and eleven female paraprofessionals. The student population at DeBerry School consists of 52.2 percent male and 47.8 percent female students. The school is racially and ethnically diverse--29.0 percent White, 37.2 percent Black, 33.3 percent Hispanic and less than 1 percent Asian.

Computer facilities at DeBerry consist of a Chapter 636 computer lab and a Chapter I classroom with computers in it. The Chapter 636 computer lab has eight terminals, while the Chapter I computer classroom has four terminals. A computer resource teacher in the Chapter 636 computer lab is responsible for the computer instruction. In the Chapter I room, a teacher is responsible for teaching mathematics and language arts as well as coordinating computer instruction.

Brightwood Elementary School

Brightwood Elementary School is located in the North End section of Springfield. The staff members of the Brightwood school consist of a male principal, twenty-eight female teachers, two male teachers, and fourteen female paraprofessionals. The student population at Brightwood school consists of 54.0 percent male and 46.0 percent female students. The school is racially and ethnically diverse--19.8 percent White, 15.9 percent Black, and 64.3 percent Hispanic. Computer facilities at Brightwood consist of a Chapter 636 lab and a Chapter I lab with ten terminals in each lab. Brightwood has two computer resource teachers, a Chapter 636 computer resource teacher and a Chapter I computer resource teacher.

Computer Training

The Springfield School Committee, the Superintendent of Schools, the Deputy Superintendent, and the two Assistant Superintendents have supported a program aimed at school improvement. At the same time, with Proposition 2-1/2 limitations, many support services suffered cutbacks. In 1986 a new Assistant

Superintendent of Instruction and Staff Development renewed efforts to establish ongoing staff development programs.

The Springfield Public School System has spent considerable sums for purchasing computers in elementary schools. The Springfield School Committee, based on a recommendation from the Superintendent, decided to purchase a mainframe system--the Digital PDP 11/44 with terminals to be used at several elementary schools. The software used on the system is the Dolphin Curricula, developed by the Houghton-Mifflin Company. This Dolphin Curricula offers computer-based instruction in reading, language arts, mathematics computation and mathematics problem-solving. This is an individualized, learning program which can be used to support and complement the curriculum being used. Many teachers, at this point in time, would like to develop their own simple programs to reinforce the Dolphin Curricula. Other teachers have expressed the wish to teach their students programming skills in BASIC.

One major concern voiced by many teachers in the Springfield Public School System is the lack of teacher training on the computer system. Efforts have been

made to address this concern by offering summer inservice training and after school inservice training to teachers with pay. Nevertheless, responses from a needs assessment conducted by the Chapter I Program of the Springfield Public School System in April, 1986 indicated computer inservice training as one priority area for professional development. Responses further indicated that teachers wanted: a) opportunities to share concerns with other staff members, and b) to be involved in the planning of their own staff development activities.

Delimitations and Limitations of Study

This study was conducted within the following delimitations:

1. Staff development activities were conducted in two public elementary schools.

2. Activities conducted during this study utilized the Digital Hardware PDP 11/44, the only equipment available at these two schools.

3. The researcher worked with the Superintendent, Deputy Assistant Superintendent, principals, resource teachers, teachers, paraprofessionals and students in kindergarten to fourth grade at two elementary public schools, and various district administrators and support personnel.

The primary limitations affecting this study were factors related to teacher willingness to participate

on a voluntary basis. Other limiting factors related to local conditions and time frames. Specifically, the limiting factors of this action-research study were as follows:

1. The selection, made from the choice set of activities that would bring about goal attainment, was contingent on the available resources.

2. Any decisions regarding the number and schedule of the sessions conducted with staff depend on the participants' willingness to participate.

3. The activities chosen for each session were continually affected by the hardware and software limitations.

4. Other choices made were further dictated by local conditions, personalities, and time frames.

5. There was no attempt to control for research bias as the researcher designed and conducted all sessions.

6. There was no attempt to control for other variables that could cause achievement to increase. Some possible causes will be identified and reported.

Significance of the Study

The significance of the study exists on two levels--theoretical and practical. On the theoretical level, the study develops from a synthesis of research in the field of staff development, specifically for urban

elementary schools, to serve as the starting point to guide practice in advancing effective computer utilization and appropriate mathematics activities in the context of school change via staff development. On the practical level, the significance of the study is inherent in the potential usefulness of the consequences for staff and students in terms of building their own mathematics and computer confidences, reducing their mathematics and computer anxieties and establishing an equitable education for all students.

The staff development aspect illustrates that effective change can occur through the involving of staff members in the planning and implementing of the staff development activities. The process of engaging participants in dialogue, planning and hands-on experience in staff development activities with the goal of enhancing student learning through effective computer utilization and appropriate mathematics activities will be a realistic approach for bringing about effective change. Involving teachers in the beginning stages and empowering teachers to bring about change will be important in bringing about favorable conditions in which effective staff development can

blossom in a structure allowing for continuous modification.

Providing teachers with the support and encouragement to become involved in change must begin by acknowledging the realities of teachers' attitudes and needs. Teachers are key to influence the learning environment. Neglecting to recognize teachers' impact on the learning environment as well as failure to consider the importance of the teacher as learner, all contribute to disappointing staff development efforts (McLaughlin and Marsh, 1978). Encouraging school personnel to learn new skills requires creative approaches similar to those teachers use with their students. Emphasizing collaborative planning and active involvement of participants leads more realistically to the development of a flexible design for staff development, reflecting varied perceptions of needs and learning styles and utilizing teacher expertise and originality.

Based on the current understanding of staff development and effective change, other teachers and other school districts cannot directly impose the action plan developed for Springfield on their own setting and school. Others may find within this study

suggestions, experiences, applications, and recommendations that could be tried in their own situation. Summarily, while others cannot borrow directly from this action plan, they can borrow the procedures and the context to approach school change realistically.

Chapter Outlines

Chapter II explores three major sets of research studies: "math anxiety", computers in education, equity issues concerning mathematics and computers--by examining the literature that is related in the interconnection of these three areas in pursuit of an operational theory to guide the practice and procedures employed. The review of related literature was organized around issues the researcher believed were critical considerations in establishing mathematics and computer programs at the elementary school level.

A significant part of this document chronicles the initial steps taken to establish a workable plan for carrying out staff development activities in Chapter III, while Chapter IV describes the staff development activities conducted. A major part of the assessment consists of forthright logs which describe what took

place as the steps in the process unfolded. The last chapter will answer the questions proposed in Chapter I and give recommendations for future studies.

Chapter II

Review of Literature

Introduction

The conceptual framework for the literature reviewed in this chapter is illustrated in the Venn diagram below (See Figure 1). The same framework serves as the foundation on which the study stands when the procedures in the process are set forth.

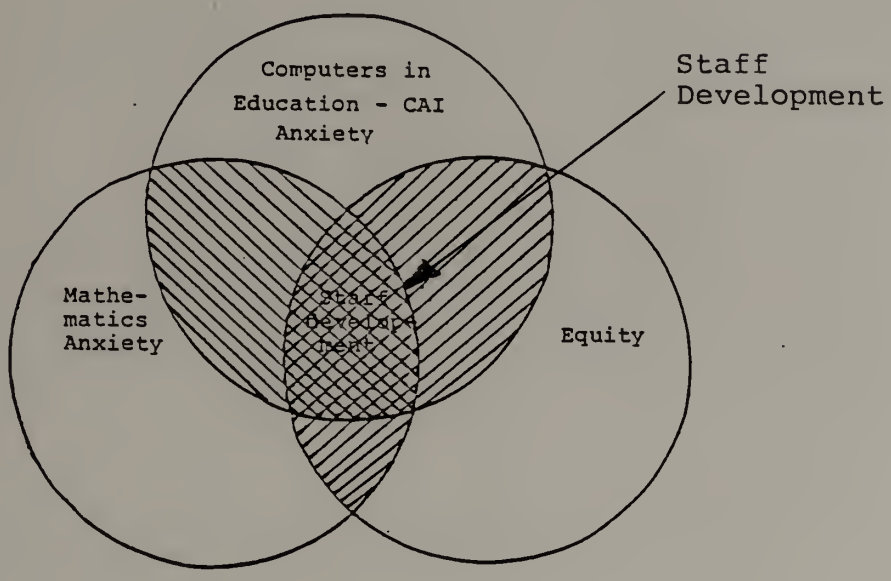


Figure 1. Research areas Venn diagram.

This conceptualization draws on three general areas of research--mathematics anxiety, computers and their impact on education, and equity. The intersection of the three sets is staff development and its impact

on these three areas of research. The theory that guides the staff development activities to bring about effective change examines the three separate sets of research--mathematics anxiety, computers in education, and equity issues in mathematics and computers.

A Venn diagram would render three sets of elements or bodies of research and their intersecting parts. Each body of research alone, examines a set of elements which may or may not be relevant to the elements in the remaining sets. Staff development, the intersection of the three sets of research, serves to tie the process together.

The literature review will discuss the three sets of research and all of the intersected areas. The connection grows out of the process of engaging participants in dialogue, planning and hands-on experiences in a staff development process with the goal of enhancing student learning through effective computer utilization and appropriate mathematics activities.

The articles and books included in this review of literature, comprising both published and nonpublished material, were identified through a number of sources, including a computerized search of ERIC and Dissertation

Abstracts International, followed by a hand search of the following journals: Journal for Research in Mathematics Education, American Educational Research Journal, Review of Educational Research, School Science and Mathematics, Journal of Educational Psychology, Sex Roles: A Journal of Research, Educational Leadership, Journal of Negro Education, and The Computing Teacher. In addition, professionals in the fields of mathematics, equity, and computer science directed the researcher to recent reports and unpublished articles that would not be found in traditional sources.

The literature review focuses on staff development techniques which have proven effective in urban elementary school and which maintain a stronger emphasis on process than on product. The process aims to establish a synergy via open communication, cooperative learning, and immediate feedback. The literature reviewed specifically The Rand Change Agent Study (1978), Phi Delta Kappa (1980), and Wood, Thompson & Russell (1981) emphasized the importance of process and active involvement. By involving learners in hands-on experience the emphasis is not placed on the instructor or on the information the instructor imparts,

but on the processes and activities the participants are involved in.

Mathematics Anxiety

In the past ten years, much attention has been paid to the negative effect of mathematics anxiety in girls and minorities (Kogelman & Warren, 1978; Tobias, 1978). Research has also been completed to determine the effect of mathematics anxiety in elementary school teachers (Riedesel, 1980; Tishler, 1980). The literature reviewed concerning students and/or teachers indicated no single factor can account for the causes of mathematics anxiety; however, many researchers have defined mathematics anxiety.

Buxton had defined "anxiety toward mathematics as a feeling of apprehension, out of proportion to any actual threat, which is experienced in reaction to a situation involving the use of mathematics" (Buxton, 1981, p. 28). Tobias and Weissbroad (1980) emphasized "'math anxiety' was used to describe the panic, helplessness, paralysis, and mental disorganization that arise among some people when they are required to solve a mathematical problem" (p. 65). Elliott (1983) stated "there are measurable physiological and

observable psychological factors which contribute to mathematics anxiety, and these factors can be contrasted with the psychophysiological correlates related to mathematics creativity" (p. 777).

Studies of mathematics anxiety revolve around two major themes. In the first place, mathematics-anxious individuals report feelings of panic when confronted with mathematics. Tobias (1978) described this feeling as sudden death. "Victims felt that a curtain had been drawn, one they would never see behind, or that there was an impenetrable wall behind; or that they were at the edge of a cliff, ready to fall off" (p. 45). Kogelman and Warren (1978) described the feelings of mathematics-anxious individuals where, when panic stricken, their ability was strained to the point of being perceived as an unsurmountable barrier.

In the second place, mathematics-anxious individuals often associated the beginning of their anxiety with negative experiences. These experiences usually involved a parent or teacher. Kogelman and Warren (1978) defined their own mathematics experience in terms of ". . . an intense emotional reaction to mathematics based on past experiences" (p. 10). Tobias (1978) stated, "math anxious adults can recall with

appalling accuracy the exact wording of a trick question or the day they had to stand at the blackboard alone, even if these events took place thirty years before" (p. 32).

Until recently, most people have assumed that some people just cannot handle figures or do not have a "mathematical mind". With mathematical "literacy" becoming an increasingly important part of coping with modern life, educators, psychologists and others are asking why numbers should be any more terrifying than letters, and why students should not be expected to do just as well in mathematics as they do in other subjects.

Emotion is present in any learning situation. Sometimes, it has a positive impact--as helping to place the individual in a state of readiness. Nevertheless, if the emotional level is too high, it becomes frustrating. Psychiatrist Robert G. Kvarnes (1980) described anxiety as "having to do with a threat to one's sense of well-being. In particular, math anxiety is a psychological state engendered when a person experiences a loss of self-esteem in confronting a situation involving mathematics" (p. 25).

This frustration and loss of self-esteem can prevent students from performing or learning even simple mathematical tasks. It can be associated with feelings of panic, helplessness, and the inability to think, and even physical symptoms--such as, nausea, fainting, or headaches.

Staff development activities must be designed to help teachers overcome their own math anxiety before they pass their anxieties on to their students. The content of mathematics is already changing and is likely to change further as a result of an assessment of "what students ought to know and need not know in a computer age" (N.C.T.M., 1980, p. 8). More generally, the greater emphasis on thinking and learning skills that educators are calling for (Resnick, 1985) may be heightened by the move to include computers in mathematics instruction. Teacher involvement in staff development activities which are planned and implemented by teachers, themselves, can address these concerns. The subsequent section of this chapter reviews the literature on computers in education which interconnects via the process engaged in this study.

Computers in Education

The National Council of Teachers of Mathematics (N.C.T.M.) recommended the integration of computers into school mathematics program at all grade levels in class work, homework and evaluation. In its publication, the Council stated "computers should be integrated into the core mathematics curriculum; they should be used in imaginative ways for exploring, discovering and developing mathematical concepts and not merely for drill and practice" (N.C.T.M., 1980, p. 9).

Computer education can play an important role in revitalizing American education. This country's competitive position in world commerce is dependent on the quality of education that our children receive. The ability to use and process information is going to be a valuable skill in the economy of the future. "The schools that use modern technology, primarily computers, in their curricula can educate their students to be productive in our society and to help our country maintain its position in leadership" (Lautenberg, 1984, p. 13).

Numerous researchers, notably John Goodlad, author of A Place Called School, most recently have shown

that when students participate in classroom activities they hold more positive attitude toward school, and that positive attitude enhances learning. Psychologists and educators believe that "if children can be taught and motivated with computers, their attitude toward learning will be enhanced" (Turkington, 1985, p. 30).

Considerable research has also been completed in the 1980s concerning the positive benefits of Computer-Assisted Instruction (CAI) for low achievers (Griswold, 1982; Ragosta, Holland & Jamison, 1982; Saracho, 1982). The literature reviewed in the area of CAI for this study attempts to narrow the field by identifying the key figures whose contributions to school improvement had influenced the urban elementary school.

In the early 1970s, Jamison, Suppes & Butler (1970), pioneers in the area of CAI, reported "CAI could be used in compensatory education programs in urban areas where there is widespread inequities of opportunities for students and motivation is low" (p. 50). Research consistently pointed to CAI as a means to eliminating the negative classroom atmosphere created by biased teachers.

> Computers are intrinsically non-discriminatory. Computers do not pass judgment on its users; they do not select those who instruct and learn from them; their language is symbolic; and they are not

> culturally, or sex, biased. They provides an opportunity to interested users for overcoming any unfair practices; yet as used in many schools, computers are the object of selective access that favors some populations at the expense of others. (Schubert & Bakke, 1984, p. 28)

A four year study conducted by the Educational Testing Service on the effects of CAI in the Los Angeles Unified School District found that students who use computers developed positive attitudes toward computers as well as toward the subject matter, particularly mathematics (Ragosta, Holland, & Jamison, 1982).

In the literature reviewed, specifically Burns and Bozeman (1981); Kulik and Kulik (1984); Mavarech and Rich (1985); Ragosta, Holland, and Jamison (1982); and Saracho (1982) concurred that CAI holds promise for the simultaneous enhancement of disadvantaged students' cognitive and affective development.

> Characteristics of CAI, such as a curriculum specifically tailored to the individual student's level and rate of achievement, immediacy and accuracy of feedback, correctiveness, and multi-sensory modes of informational input and output, create more positive conditions for drill and practice than is possible in the typical classroom (Mevarech & Rich, 1985, p. 6).

Several educational psychologists (Bloom 1978) have argued that these characteristics are particularly relevant to the academic success of low-achieving

students. Griswold quoted in Rogosta, Holland and Jamison (1982) goes further in stating:

> The interesting and most important finding is that CAI may prove helpful to minority students and low-achieving students, by improving the extent to which they feel in control of their successes. By interacting with a computer, a student is permitted a sense of control over the learning situation without the pressures from teachers and peers. (p. 9)

Furthermore, "teachers may be partially freed from the perceived need to exert constant pressure on the pupil to master content since interaction with computers should provide the necessary drill and practice to achieve mastery" (Mevarech & Rich, 1985, p. 6).

The literature reviewed in this section suggests that CAI for low-achieving students holds promise for fostering a learning environment in which students are motivated, achieve success, and are given individualized instructions. However, this study focuses on the most beneficial computer application for each student that is appropriate to the student's academic needs.

The rationale to include more than CAI experiences for students at the elementary level in the Springfield Public School System called on an adaptation of Papert's view that the purpose of teaching programming, regardless of the language should be to let learners know they have the power over computers, to be proactive

learners and to afford them opportunities to make decisions and choices--and not necessarily to produce programmers.

The process of engaging participants in dialogue, planning, implementing, feedback and hands-on experience using computers beyond CAI serves as the channel for successfully connecting computer utilization issues with staff development activities. The quality of a school and the learning that takes place within a classroom reflect the values of the personnel within that school. This process of open communication for all staff members could provide the means to creating more effective classrooms and more effective schools. This study focuses on utilizing computers effectively to enhance learning by creating an equitable education for all students regardless of race, sex, ability level, or past experience.

Equity Issues Concerning Mathematics and Computers

Equity of access to and learning about computers has become an important topic in education. A common concern in education is that all children have equal opportunity and appropriate support for acquiring

competence with computers. These concerns derive from "the belief that, because many careers will require competence with computers, knowledge or information technology will be a source of power in the future" (Becker, 1984, p. 1); and "the fact that currently there are differences among groups of people in their access to bodies of information which may be exacerbated by unequal opportunities for learning about technology" (Brush, 1980, p. 5).

"Equal access to the benefits of the computer age is a necessity, if all students--male, female, minority, majority--are to achieve computer literacy" (Winkle & Matthews, 1982, p. 315). One writer already called computer literacy "as much a social obligation as reading literacy" (Molnar, 1978, p. 35), and another claimed that "to get along in today's technological society, people must have hands-on experience with computers before they leave their formal schooling" (U. S. News and World Report, Jan. 8, 1979, p. 40).

If computer literacy is fast becoming a basic skill, then schools must consider the question of equal access to this skill for each student and teacher. However, this is not happening. Becker (1985b) observed that racial and socio-economic groups that have

historically suffered from lack of equity are not receiving the access to computers that their more advantaged contemporaries take for granted.

Several studies reported large differences in the availability of computers between well-off and poor districts (Alvarado, 1984; Becker, 1985a). Differences have also been found between predominantly minority and White districts, and among regions of the country (Sanders, 1984). These disparities raise concerns that a new form of segregation is developing, "separating those who are familiar with, and competent to deal with, the new technology from those who are not" (Campbell, 1986, p. 516).

A survey conducted by the Johns Hopkins Center for Social Organization of Schools found that "in January, 1984 nearly 70 percent of the schools in more affluent communities had at least one micro-computer, while only 40 percent of the schools in poorer communities were so equipped" (Becker, 1985b, p. 16). This study found Black and Hispanic students had about the same proportion of computer access as low income students. "About 57 percent of high-income area elementary schools had at least one computer, while

only about 31 percent of low-income elementary schools had a computer" (p. 16).

Several recent studies have indicated that boys have greater access to computers than girls (Becker, 1984, 1985b; Campbell, 1986; Hess & Mivra, 1985; Lockheed, et al., 1985). Sheingold (1981) reported that more boys at all grade levels use computers more frequently than do girls. Differences in access have also been reported, "with more boys having access to computers at a friend's house, more boys learning about computers from friends, and more boys attending computer camps" (Miura & Hess, 1984, p. 22).

A recent report, Learning Her Place: Sex Bias in the Elementary School Classroom found that the "classroom climate continues to be heavily influenced by sexism as well as racism, often despite the good intentions of dedicated teachers" (Peer Computer Equity Report [PEER], 1984, p.3).

Elizabeth Fennema, a mathematics education researcher at the University of Wisconsin-Madison, cautioned one must:

> . . . keep in mind that many, many girls are exceptionally good at math and computer science, and believe rightly that they are. Overall, the differences between males and females are really very small. It's just that the students who are

> less confident are more often the girls. (Fennema, April 5, 1986 conversation with researcher)

Schakeshaft (1986) concurred:

> Unfortunately, few schools provide an equitable culture in which all students can grow. Most offer white males more options in an environment that is hospitable to their needs. Females and members of minority groups learn that their concerns, their lives and their cultures are not the stuff of schooling. (p. 500)

This environment translates into unequal conditions and low expectation for female and/or minority students. In his discussion of Changes and Institutional Racism, Jones (1972) noted:

> as long as schools successfully impose obedience and respect upon Black children, there will be no opportunity for those children to demonstrate initiative, ability and responsibility. Teachers who have excused the failures of urban schools on the basis that "those" children cannot learn, no longer expect their classes to learn. (p. 84)

Levels of expectations for females and/or minority students will remain low unless teachers' expectations for these groups of students change and these students are given opportunities to become active participants in the learning process. Involving all students in computer activities beyond CAI could result in more active learning for all students.

The real issue in ensuring equity in computer usage is not the quantity of computers that are in a

school, but rather how these computers are used with students (Becker, 1985a) addressed this issue:

> When computers are introduced into suburban schools, it is often for the purpose of computer programming. In less affluent schools, CAI is used almost exclusively. In other words, affluent students are telling computers what to do while less affluent students are doing what computers tells them to do. (p. 115)

Educators committed to ensuring equity in computer instruction should be concerned not with the quantity of computers in a particular school, but rather with how computers are used by students. Likewise, educators must be concerned with the quality of the mathematics instruction for all students. Mathematics anxiety has limited career options for too many able females and minorities (Campbell, 1983). Computer anxiety could have an even more devastating effect on the female and minority students (Campbell, 1986).

Regarding equity, mathematics and computers, Lipkin (1984) stated:

> Equity interests would be best served by supporting rather than severing the link between mathematics and computer courses. . .By joining computer courses with the study of mathematics for students, computers could serve as a bridge to the study of mathematics if the content were properly structured and geared to the level and capacity of the individual student. (p. 19)

The process of engaging staff members in dialogue, planning, hands-on experience and feedback in using

computers and developing mathematics activities with the goal of enhancing student learning through effective computer utilization and appropriate mathematics instruction could serve as a means of creating more effective schools. This study focuses on establishing high expectations for all students by addressing computer and mathematics equity issues for all students whether Black, Hispanic, White, male, female, high achiever, or low achiever in an urban elementary school setting.

Equity can be achieved through careful innovative planning. Computer and mathematics education must be provided for all students in a manner consistent with the educational goals of equity and excellence. These goals must be mutually attained. The active involvement of teachers in hands-on learning activities and the application of practical staff development principles represent a realistic approach for attaining these goals.

Staff Development

A revitalization of our American education, specifically in mathematics, would require a commitment to self-renewal through continuing individual growth

and participation in activities that prepare today's teachers to cope with the changing needs of today's society--an age of computers, technology, and mathematics. In April 1986, the N.C.T.M. issued a statement on Professional Development Programs for Teachers of Mathematics:

> Because mathematics and education are disciplines that grow and change, teachers cannot depend on what they learned as undergraduates to carry them through their entire careers. Findings of research continually increase our understanding of teaching and learning. Further, social and technological changes increase the average citizen's need to understand and use mathematics. These forces demand reconsideration of the content and methods of mathematics instruction. (p. 1).

This author's investigation rests on the findings which call for educators to work closely at school-based staff development (Berman & McLaughlin, 1978; McLaughlin & Marsh, 1978; Phi Delta Kappa, 1981; Wood, Thompson & Russell, 1981). Staff development efforts should strive to create a synergy via collaborative efforts, which necessarily involves participants in the planning and implementing stages of the process. This type of collaboration aims at building consensus and reaching goal attainment as essential elements for initiating change.

Essential change involves altering people's attitudes and behavior as well as providing them with

new skills and techniques. Sarason (1982) warned that schools have a distinctive culture that must be understood and involved if changes are to be more than cosmetic. Little (1981) concurred using a focused ethnographic methodology to study effectiveness in six urban schools. She pointed out the importance of the school setting as a variable to influence staff development efforts and effectiveness.

The most extensive current discussion of the differences among schools is described as the "effective schools research" (Edmonds, 1978). It has been so named because schools have certain characteristics described as effective and compared with others seen as less effective.

> The characteristics of an effective school are (1) the principal's leadership and attention to the quality of instruction; (2) a pervasive and broadly understood instructional focus; (3) an orderly, safe climate conducive to teaching and learning; (4) teacher behaviors that convey the expectation that all students are expected to obtain at least minimum mastery; and (5) the use of measures of pupil achievement as the basis for program evaluation. (Edmonds, 1982, p. 4)

Other researchers have discussed the importance of school-based staff development. Joyce and Showers (1980) suggested that staff development should be school-based and lead to classroom application. Nicholson, Joyce, Parker, and Waterman (1978) have

found that "teachers prefer inservice training presented in school-sites because it is convenient and can relate to classroom activities" (p. 27).

Lezotte's (1980) study of urban school improvement reported that:

> Staff development programs ought to involve all or as many teachers from a single school as possible. This will serve two purposes, (1) it will increase the likelihood that the prevailing beliefs and norms can be adjusted to accommodate the change, because more members of the social system are motivated to do so, and (2) it provides a support group for the teachers who are motivated to implement change. (p. 16)

Providing school personnel with the support and encouragement to become involved in effective inservice must begin by acknowledging the realities of teachers' attitudes and needs. The demands on teachers today require that they be active learners continuously adapting to changing school and individual student needs.

Teachers can be convinced that much of the expertise for renewal can be legitimated and found among innovative teachers themselves (McLaughlin and Marsh, 1978). Although there is some disagreement as to the appropriate time teachers need to participate in school improvement as initiators, decision makers, collaborators, there can be no question that continuous

participation is a critical component in school improvement.

Confirming this point the Rand Change Agent Study, McLaughlin and Marsh (1978) found that the greater the effort required of project teachers, and the greater the overall change in teaching style attempted by the project, the higher the proportion of committed teachers. Complex and ambitious projects are more likely to elicit the enthusiasm of teachers than are routine and limited projects. McLaughlin and Marsh (1978) believed that ambitious projects appeal to a teacher's sense of professionalism. Evidence from the Rand Change Agent Study, Berman & McLaughlin (1978) indicated that a primary motivation for teachers to take on extra work and other personal costs of attempting change is the belief that they will become better teachers and their students will benefit. Berman and McLaughlin (1975) equate 'ownership' as "inservice programs that allow individuals to work through and understand project precepts and to develop an awareness of the project's methods and goals" (p. 19).

A large portion of the research of effective schools, specifically the Rand Change Agent Study (McLaughlin & Marsh, 1978), emphasized that change

efforts have been disappointing because teachers' individual training needs have been neglected. The teacher is the key person to influence the learning environment. Neglecting to recognize teachers' impact on the learning environment, their needs and their attitudes, as well as failure to consider the importance of the teacher as learner all contribute to disappointing staff development efforts. Wood, Thompson and Russell (1981) suggested that conditions related to the adult as learner will also determine the quality of the change process. Moreover, as the Rand Change Agent Study (McLaughlin and Marsh, 1978) concluded, the most effective planning strategies were those which were collaborated and broad-based--the process engaged in this author's study.

Collaboration among teachers helps to eliminate the teacher isolation so prevalent in many schools. Many school systems have found that small group interaction among teachers is very beneficial for teacher support concerning day-to-day change which occurs within their school. Teachers more consistently continued the work they have begun in inservice training sessions when their activities increase their own personal needs (Wood, Thompson & Russell, 1981).

Emphasizing collaborative planning leads more naturally to the development of a flexible staff development design reflecting varied perceptions of needs and learning styles and utilizing teacher expertise and originality. Encouraging school personnel to learn new skills requires the same creative approaches we ask teachers to use with their students. Rubin (1986) noted:

> When staff development is conducted within the school setting, the conditions under which staff learn are the same conditions under which they work. Therefore, the school conditions will affect the quality of learning that occurs for teachers as well as students". (p. 43)

The process of engaging participants in open communication and cooperative learning can provide the means toward creating more effective classrooms and schools.

Summary

Research has pointed out that by the end of the 1980s many of the simplest access problems may be solved as more schools acquire computers. Much work remains to be done on the availability of non-biased computer usage for all students. Although the increase in the number of students using computers will give the

appearance of equal access, more subtle inequities may remain. As Christopher Dede (1981) noted, "if equal access to high quality instructional technology designed to meet the needs of diverse groups were guaranteed, educational discriminations and equality might be reduced" (p. 215).

Literature on staff development and school change has pointed to the importance of involving participants in hands-on experience (Berman & McLaughlin, 1978; Joyce & Showers, 1980; McLaughlin & Marsh, 1978; Phi Delta Kappa, 1980; Wood, Thompson, & Russell, 1981). The emphasis on actively involving teachers in staff development activities holds promise for improving the teacher's familiarity with computers as well as improved mathematics instruction and, therefore, fostering a learning environment in which students are motivated, develop their own self-confidence and become active learners.

Expectations for minority and female students will remain low unless teacher expectations of students improve. The active involvement of teachers in staff development activities represent a realistic approach for improving teachers' expectations for themselves and teachers' expectations for students. The improvement

of teachers' computer confidence and mathematics background through their active involvement in hands-on activities in staff development that are planned and implemented by these participants could result in creating a learning environment for all students, regardless of sex, race, ability level, or past performance. The process of involving participants in open communication, program planning, implementing and feedback can provide a forum for establishing a staff development in computer utilization and mathematics activities and the means toward creating more effective classrooms and schools.

The review of literature on staff development for this study is based on a synthesis of researchers in the field of staff development for urban schools. After reviewing the literature, the researcher noted that there were a number of generally agreed on key steps for implementing staff development activities. These key steps, which reflect the research of Berman and Mclaughlin (1978); McLaughlin and Marsh (1978); Phi Delta Kappa (1981); and Wood, Thompson and Russell (1981) as well as others in this field should not be taken literally as steps to follow in an effort to guarantee success.

The key steps are: 1) the school districts should be willing to provide resources and training necessary for staff development; 2) the one should mobilize broad-based support for staff development a) teachers, b) principals, c) central office staff, and d) community; 3) the school is the primary unit for change; 4) staff development activities should be ongoing and impact the quality of the school and classroom activities; 5) the principal's leadership is important for successful staff development activities; 6) the climate of the school must be orderly and conducive to teaching and learning; 7) the participant's needs must be considered in staff development activities; and 8) the teachers in a school ordinarily have the necessary clinical expertise to improve instruction and school climate.

Chapter III

Initial Planning & Staff Development

Introduction

This chapter describes the initial steps taken to establish a workable plan for carrying out staff development activities in two elementary urban schools. These events built on research by Berman and McLaughlin (1975, 1978); McLaughlin and Marsh (1978); Phi Delta Kappa (1980); and, Wood, Thompson and Russell (1981). By synthesis of their research one can infer that there are key steps for staff development, but these steps should not to be taken literally as a recipe that will assure success.

1) School districts should provide resources and training necessary for staff development. 2) School leaders should mobilize broad-based support from principals, teachers, central office staff, and community members. 3) The school is the primary unit for change. 4) Staff development activities should be ongoing and impact the quality of the school and classroom activities. 5) The principal's leadership is important for successful staff development activities. 6) The climate of the school must be orderly and conducive to teaching and learning. 7) Participant's

needs must be considered in staff development activities. 8) Teachers in a school ordinarily have the necessary clinical expertise to improve instruction and school climate.

Initial Planning

In December, 1985 the researcher met with the Deputy Superintendent of the Springfield Public Schools concerning staff development activities for elementary school teachers specifically in mathematics and computer education. The researcher noted at this point that the Springfield Public School System provided inservice training for curriculum changes whenever deemed necessary. Also, the School Committee would sponsor two graduate courses for staff members each semester as per contract. These courses vary each year.

Next, the researcher reviewed the literature and attended various inservice sessions, specifically held for elementary school teachers. After attending three National Council of Teachers of Mathematics Staff Development meetings, various college and local inservice training sessions in Mathematics and Computer Instruction, the researcher had provided inservice training to all Chapter I personnel in the area of

Mathematics and Computers from September, 1983 to January, 1986. This inservice training had been given on Friday afternoons between 1:15 and 2:45 p.m. Due to contractual obligations, the January, 1986 Agreement between the Springfield School Committee and the Springfield Education Association, inservice training for elementary school teachers could no longer be required on Friday afternoons. As of January, 1986 inservice training scheduled for elementary school teachers would be given on a volunteer basis after 3:00 p.m.

Initial communication for this staff development project for elementary school teachers in mathematics activities and computer utilization involved dialogue between the Deputy Superintendent and the researcher in July and August of 1986. At these meetings, the researcher explained exactly what she intended to do and mentioned six elementary schools as potential sites. The schools were: Armory, Brookings, Brightwood, DeBerry, Dorman, and White Street School. The Deputy Superintendent identified DeBerry, Brightwood, and White Street School as his choices. DeBerry, Brightwood and White Street School were chosen by the Deputy Superintendent because of the high minority enrollment

at each school and because of the involvement of a Chapter I computer program at each site. After lengthy discussions regarding time, staff commitment, and equipment limitations, the Deputy Superintendent and the researcher agreed to try to implement change at the DeBerry, Brightwood and White Street Elementary Schools.

The Deputy Superintendent suggested that the researcher meet with the Assistant Superintendent of Instruction and Staff Development and with the Supervisor of Mathematics and Computers. The Supervisor of Mathematics and Computers agreed to help the researcher in planning and implementing mathematics and/or computer activities in any of the elementary schools chosen. He thought staff development would be an appropriate vehicle to use to introduce elementary school teachers to computer applications in a mathematics lesson. The Assistant Superintendent of Instruction and Staff Development approved the researcher's proposal.

The initial steps taken involved dialogue with central office administrators whom the researcher viewed as support for this project. The literature reviewed, specifically, Wood, Thompson, and Russell (1981)

suggested that in the early planning stages of staff development the focus should be on mobilizing broad-based support for staff development. "This support is obtained through the involvement of teachers, principals, central office staff, school board members and parents" (p. 65). Research conducted by the Rand Corporation indicated that for changes in school practices to occur and last, this broad-based involvement is essential (Berman & McLaughlin, 1978). Support generated by these conversations enabled the researcher to develop a plan that focused on a school climate with open communication among staff members.

Initial meetings in August of 1986 with the Deputy Superintendent, the Assistant Superintendent of Instruction and Staff Development, and the Supervisor of Mathematics and Computers confirmed that staff development efforts represented an appropriate and expeditious means for improving mathematics instruction and computer utilization. Although the researcher would have preferred to have teachers released during the school day for staff development activities, this was not feasible.

The Deputy Superintendent agreed, however, to allow the researcher to plan these staff development sessions

for Friday afternoons. The Deputy Superintendent insisted that the researcher inform everyone involved in this project that involvement would be on a voluntary basis. Friday afternoons, however, created problems for many classroom teachers who hold parent conferences on Fridays. The researcher did meet with classroom teachers during the school day or after the school day whenever participants requested.

Mathematics and Computer Issues

The content of intended workshop sessions could not be predetermined because their content necessarily depended on feedback from participants. However, there was a consensus among principals, teachers, and administrators that the mathematics instruction for elementary school students was inadequate in many cases. At the elementary school level in the Springfield Public School System an approved mathematics curriculum had not been established as of September 1986. Many classrooms throughout the system used outdated text and many teachers at the elementary school level had not received any inservice training in the area of mathematics since leaving college.

Nye (1986) addressed this issue:

> Not all teachers understand the difference between teaching procedures and teaching reasoning in arithmetic. Although they are proficient with the computational algorithms, many teachers were not taught the reasoning behind them. Teachers cannot teach what they do not truly understand themselves. (p.3)

Analogous to the mathematics issues, principals, administrators, and teachers agreed that computer instruction for elementary school students was another problem area. Computers were not operating with maximum efficiency and to the fullest potential to enhance learning. Computer education began in the Springfield Public School System at the elementary level in 1983. Four elementary schools were involved in the first corporate contribution from the Digital Equipment Company. A PDP 11/44 with VT 220 terminals were purchased to be used at Armory, Lincoln, Brunton and DeBerry Elementary Schools.

Throughout the 1980s the number of students served by this computer system increased dramatically; however, in many cases the training for the teachers has been minimal and the integration of computers into the elementary curriculum has not been completed. Interviewing teachers over the past two years, the researcher surmised that many elementary school teachers

in the Springfield Public School System had not participated in any inservice training in the area of computer utilization. Many teachers at the elementary school level voiced concern of how and when to use computers in their instruction with students.

Need For Inservice Training on the Elementary School Level

For the past two years, there had been dissatisfaction among elementary school teachers with regard to the mathematics curriculum. Again, interviewing various elementary school teachers in the Springfield Public School System, concerns were voiced regarding the present mathematics curriculum and lack of inservice training provided to teachers. Some elementary teachers were also dissatisfied with the curriculum that had been adopted for use at the elementary school level. Part of this dissatisfaction was due to the manner in which the mathematics curriculum was implemented.

The planning phase for the curriculum covered approximately eighteen months and involved between fifteen and twenty teachers. The researcher was one of these teachers. However, the implementing phase of

this curriculum did not allow for teacher involvement. Teachers were handed the mathematics curriculum with a set of guidelines to be followed at each grade level and told to implement it.

McLaughlin and Marsh (1978) suggested that a critical factor affecting the outcome of local change efforts was the project implementation strategy. They write "among the most important choices made during the initial planning period were these about how to put the project into practice" (p. 76). This finding coincided with the researcher's belief that appropriate staff training activities and staff support activities provided to staff members could account for a substantial part of a project's success and continuation.

Teachers on the elementary school level in the Springfield Public School System were also dissatisfied with computer utilization in the elementary schools. As previously metnioned, computer education began in the Springfield Public Elementary Schools in 1983. However, teacher training in computer utilization at the elementary school level was almost non-existent. Exactly ten elementary schools have offered computer training in CAI application to staff members.

Furthermore, only five teachers at the elementary school level have had previous computer programming training. Statistics provided by the Mathematics and Computer Department of the Springfield Public School System.

The situation of the Chapter I computer program in the Springfield elementary schools is basically the same. In September, 1985 the Chapter I department of the Springfield Public School system implemented a computer system for all Chapter I schools. The Superintendent of the Springfield Public School System, with the recommendation of the School Committee, purchased similar equipment to the corporate contributions; Digital PDD 11/44 mainframes and VT 220 terminals. The staff training efforts and the staff support efforts have been minimal. Many staff members were concerned with their own ability to use the system. Research conducted by Sheingold, Martin, and Endreweit (1985) on Preparing Urban Teachers for The Technological Future stated:

> Teachers should be supported and encouraged to adapt computers to their own and their students' purposes, to explore the ways in which technologies can alter what happens in the classroom, and to share what they do and what works with other teachers. In districts with large numbers of poor and minority students, such an approach will make possible local design and implementation

> of programs that may be of particular benefit to such students and to their teachers. (p. 14)

Developing a Base of Support

In concert with these initial conversations, the researcher met with the principals from the district's three elementary public schools at separate meetings. The primary purpose of these meetings, in addition to detailing the logistics of the proposed staff development sessions, was to obtain permission for the staff development activities. The researcher anticipated that the principal was the key person at each school who would generate enthusiasm for this project. The researcher discussed the importance of staff development, specifically for elementary school teachers in mathematics and computer utilization. Each principal agreed and allowed the researcher to meet with the staff at school.

Sarason (1982) viewed schools as having a distinctive culture that must be understood if changes are to be more than cosmetic. Sarason noted "any attempt to introduce change into school setting requires among other things, changing the existing regularities in some way" (p. 96). The researcher's efforts to

introduce teachers to computer activities other than CAI would involvee changing regularities in the present computer applications. At the elementary school level in all schools in the Springfield Public School System computers are used primarily for drill and practice. Computer training for elementary school teachers beyond CAI, specifically in programming, could provide teacher and student with a tool to enhance the teaching-learning process. Consequently, it would take a good deal of staff development and open communication on the part of elementary school teachers and administrators to make use of the full potential of the computer.

In the middle of August, the researcher met with the principals of DeBerry, Brightwood, and White Street Schools in separate meetings to review once again the project's goal.

School Sites

The principal at White Street School invited the researcher to discuss this study with his staff at a faculty meeting in late September. The discussion that developed centered around the many obligations and duties placed on the elementary school teacher. Although White Street School had been selected by both

the researcher and the Deputy Superintendent of the Springfield Public School System as one of the three schools to participate in this study, this staff decided, for various reasons, not to participate.

The principal at DeBerry Elementary School from the initial conversations with the researcher showed much enthusiasm for the possibility of her school being involved in this project. This particular principal wanted the researcher to meet with the mathematics resource teacher and the computer resource teacher to discuss this project before meeting with the DeBerry staff. At the end of August, the researcher met with these two women. The mathematics resource teacher was very enthusiastic about her being involved in these sessions. Because of previous commitments, the computer resource teacher decided not to participate. During the first week of September, the researcher spoke at a faculty meeting and presented her study.

At DeBerry School, the staff members who volunteered included two bilingual teachers, a Chapter I mathematics/language arts teacher, a reading resource teacher, the mathematics resource teacher and one classroom teacher. Except for the one classroom teacher this group remained intact as active participants

throughout the entire project. After three sessions the classroom teacher dropped out because scheduling parent conferences was conflicting with her participation in the project. A first grade teacher, who had completed parent conferences for this semester, joined this group for the last two sessions and worked with the researcher after school on an individual basis to review sessions one, two, and three. Scheduling parent conferences and release time for staff development remained a problem throughout this project. As a result, fewer classroom teachers participated than expected.

The principal of Brightwood School, during the second conversation, suggested to the researcher to meet with the computer resource teacher to elicit her input for this project. This principal also suggested to the researcher to meet with his staff on an individual basis. The researcher spent two days talking with staff members in an effort to generate enthusiasm for this project.

At Brightwood School, the staff members who volunteered were a bilingual teacher, a computer resource teacher, a Chapter 188 resource teacher, a Chapter I computer teacher, three fourth-grade teachers,

four Chapter I mathematics/language arts teachers, and an assistant teacher. The group remained intact as active participants throughout the entire project.

At DeBerry School and at Brightwood School, both principals suggested that the researcher meet with key personnel before presenting her proposal. From the beginning of this project, the researcher met with the principal at each school before and after each session to discuss the agenda that would be followed. Rubin (1986) suggested "the collaborative efforts of people in key positions and other staff members agreeing to the project promised that change could occur to bring about more favorable conditions in which staff development could flourish" (p. 186).

Summary

The study by Phi Delta Kappa (1980), Why Do Some Urban Schools Succeed? formulated generalizations on factors associated with success in urban elementary schools. Two generalizations specifically addressed staff development:

> (1) Successful schools and programs frequently utilized staff development or inservice training programs to realize their objectives. (2) The greater the specificity or focus of the training

> program in terms of goals or processes, the greater the likelihood of its success. (p. 205)

Establishing staff development activities has been shown to be a key process for creating successful schools. The researcher found in this study involving principals, teachers, paraprofessionals and other staff members in planning and implementing their own staff development to bring about change was a critical part of this process.

Research has shown that the teacher affects the quality of learning that takes place in a school (Goodlad, 1984). Referring to mathematics instruction N.C.T.M. (1984) noted "teachers must continue their own development to keep abreast of changing needs, tools, and conditions in the mathematics curriculum. School districts have the responsibility to make this possible by providing continuing inservice education" (p. 24). Elliott (1974) suggested that computer training programs for teachers could improve teachers self-confidence and critical thinking skills.

The synthesis of the research completed for this study in the field of staff development established key steps for implementing staff development activities. These key stps are:

1. School districts should be willing to provide resources and training necessary for staff development. The Springfield Public School System would encourage voluntary attendance and use of school materials for staff development; however, the school district would not encourage release time during the school day or any type of monetary incentive for involving their teachers in staff development activities.

2. One should mobilize broad-based support for staff development, principals, teachers, central office staff, and community members. The interest of the Deputy Superintendent in these work sessions sparked an interest in the Supervisor of Mathematics and Computers to further investigate the possibility of exposing the elementary school teachers in the Springfield Public School System to computer utilization beyond a CAI approach. However, the principals in this study were not equally enthusiastic about these staff development activities. The principal at White Street School decided not to participate; and, although the principal of DeBerry School was very enthusiastic about these work sessions, this was not critical to teacher involvement.

3. The school is the primary unit for change. This study illustrated that, although school-based needs overlapped in certain areas, each school site has its own creative way to use the potential teaching resources to produce positive change.

4. Staff development activities should be ongoing and impact the quality of the school and classroom activities. The work sessions conducted in this study only started a process that must be continued on an ongoing basis if appropriate mathematics activities, effective computer utilization, and an equitable education for all students are to be established.

5. The principal's leadership is important for successful staff development activities. The principal's attendance at these work sessions did not directly encourage teacher participation. In fact, at one school where the principal was involved only six teachers participated from a staff of twenty-five.

6. The climate of the school must be orderly and conducive to teaching and learning. Participants in these staff development work sessions could not envision the feasibility of using cooperative learning or peer-coaching situations in a mathematics classroom. These approaches are typically not used in a mathematics

classroom. However, after participants themselves were involved in cooperative learning and/or peer coaching situations, participants began to realize the positive benefits their students could gain from these approaches.

7. Participant's needs must be considered in staff development activities. Before beginning this study, the researcher interviewed five elementary school teachers from the district for their input concerning a staff development program for elementary school teachers, specificially in computer utilization and mathematics. From the teachers' input, a needs assessment survey instrument was developed for this study. Teachers who volunteered to participate in this study prioritized this list of needs based on their own individual needs. The staff development work sessions for each school were established from the prioritized needs.

8. Teachers in a school ordinarily have the necessary clinical expertise to improve instruction and school climate. This study concluded that teachers working together, using the resources available, empowered themselves by identifying and prioritizing needs and then developing an action plan which met the

objectives of the district's currciulum and operated in a coherent framework with a sound understanding of computer and mathematics education.

The initial procedures followed thus far provided the researcher with insights concerning the Springfield Public School System's position on staff development. These insights and the process of involving staff members in planning and implementing change by open communication, hands-on experience, and immediate feedback guided the procedures engaged in this author's study.

Chapter IV

Introduction

Between September 19, 1986 and January 9, 1987 a series of ten workshops were conducted in two Springfield elementary schools to plan and implement positive changes in computer utilization practice and mathematics activities by using staff development as the vehicle of change. Staff development techniques were applied to involve administrators, teachers and other staff members in working together. This chapter chronicles the objectives, procedures, the theoretical assumptions that the procedures were based on, and feedback results of each workshop session.

DeBerry Session 1

On September 19, 1986, six participants including one mathematics resource teacher, two bilingual teachers, one Chapter I mathematics/language arts teacher, one reading resource teacher, and one classroom teacher gathered in the DeBerry School Library for the initial planning session. Following are the objectives, procedures, theoretical assumptions, and feedback from the first session.

Objectives

The specific objectives of session 1 were:

1. To outline the plan for involving the teachers in their own staff development activities;
2. To discuss, and then, complete the needs assessment survey;
3. To analyze and prioritize the needs assessment data and to target objectives;
4. To generate dialogue on computer utilization issues and mathematics instruction issues; and
5. To establish a time-line specifically for these work sessions.

Theoretical Assumptions

The inclusion of the following procedures for this work session were partially based on the findings of McLaughlin and Marsh (1978), which emphasized the importance of teacher involvement in the planning of staff development efforts; and partially based on the findings from Wood, Thompson and Russell (1981), which emphasized the importance of all staff members to be able to communicate with other staff members concerning staff development efforts.

Procedures

The following activities correspond by number to the objectives stated:

Activity 1--Outlining Plans. The session began with a discussion on involving teachers in their own staff development.

Activity 2--Needs Assessment Survey. The researcher presented each participant with a needs assessment survey (see Appendix A). The survey was developed by the researcher and five elementary school teachers who had volunteered to work with the researcher. The needs assessment survey listed various perceptions of computer instruction needs and mathematics instruction needs. The participants completed the needs assessment instrument.

Activity 3--The group prioritized the needs according to individual needs. The following items were cited as pressing needs for the DeBerry School participants:

a.) Developing classroom activities appropriate to a grade level in mathematics--29

b.) Participating in a workshop to learn BASIC--8

c.) Developing one's own computer software--6

d.) Promoting more teacher involvement--6

e.) Developing classroom activities appropriate to a grade level in CAI--6

f.) Building computer skills in students by using off computer activities--6

g.) Reviewing the issue of mathematics and minorities--5

h.) Building one's own familiarity with computers during hands-on activities--4

i.) Learning how to write and run a simple program--4

j.) Developing practical activities to be integrated into computer time--4

k.) Encouraging family mathematics activities--4

l.) Helping parents gain a better understanding of computers--3; and,

m.) Pursuing the issue of mathematics and female antipathy--2.

The following items were cited as urgent needs:

1. Developing classroom activities appropriate to a grade level in mathematics;

2. Developing one's own computer software.

Teachers evaluated the data to determine which items should constitute long-range goals, and which should

constitute short-range goals. Following is an objective for long and short range goals.

Short-Range

Conduct workshops to train staff in computer use.

Long-Range

Conduct workshops to train staff in developing mathematics activities.

Activity 4--Mathematics and Computer Issues Discussion. Dialogue centered around issues that were believed to be prerequisite in developing appropriate computer and mathematics activities for students. The following beliefs gave direction to the activities that would be developed through these work sessions.

A. The mathematics activities should:
   1. Be appropriate to the learner's ability;
   2. Prepare students to live in society;
   3. Ensure equity by providing equal instruction to all students regardless of sex, race, socio-economic status, or ability level; and
   4. Promote students as active participants in the learning process.

B. The use of computers in our school setting should:
   1. Be appropriate to the learner's ability;

2. Enhance student learning;
3. Ensure equity by providing equal access to computers for all students regardless of sex, race, socio-economic status, or ability level;
4. Promote students as active participants in the learning process.

Activity 5--Time-Line Discussion. Dates for the following sessions were discussed and a tentative schedule was set.

Feedback Assessment Instrument

At the end of each of the five sessions the researcher distributed a feedback assessment instrument, including three items, to gather data on the participants' reactions to the session as well as suggestions for the next session (see Appendix B-1). In the first item, the participants rated the sessions as not useful, minimally useful, somewhat useful, very useful, or extremely useful. In the second item, the participants indicated which items they found specifically practical. The third item was an open ended question included to elicit which kinds of activities the group wanted included in future sessions.

The same format for the feedback assessment was used in each of the subsequent sessions (see Appendixes B-2 to B-10). Only the activities listed under Item 2 were altered to match activities conducted in each session.

Feedback Assessment Results

Item 1. Six of the participants responded in writing to the feedback assessment. Five rated the session as extremely useful (83%) and one rated the session as very useful (17%).

Item 2. In response to the activity found specifically useful, the number of participants responding to each item were:

Discussion of computer and mathematics issues--6

Outline of the plan for involving DeBerry staff in their own staff development activities--6.

Item 3. The topics identified for exploration in future sessions and the number responding to each were:

Developing mathematics activities--4

Participating in a computer workshop--2.

DeBerry Session 2

Because the interest of the group at this point centered around hands-on activities in mathematics, the second session was devoted entirely to developing problem-solving skills and estimation skills in elementary school students. The feedback and the dialogue from the first session served as part of the rationale to include these two items on the second session's agenda. Furthermore, the inclusion of this activity is based on the fact that problem-solving concepts and skill development are a particular goal of the Springfield Public School System as well as a national focus.

To help teachers expand their perceptions of mathematics in the area of problem-solving and estimation, the researcher believes that a range of professional development opportunities could help greatly in broadening teachers' perception of mathematics and its importance. One goal of this session would be to assist teachers in developing creative, instructional approaches in the area of problem-solving and estimation that are meaningful and mathematically correct and that will instill in students enthusiasm and satisfaction in learning and using

mathematics in real life situations. The design for this workshop, therefore, would be developed using mathematics in real life situations.

On October 10, 1986 seven participants including a classroom teacher, a mathematics resource teacher, a Chapter I language arts/mathematics teacher, a reading resource teacher, two bilingual teachers, and the principal of DeBerry School, gathered in the Chapter I computer room at the DeBerry School. The researcher conducted activities on how to develop problem-solving skills and estimation skills using real life examples known to every elementary school student (see Appendix E-1).

Objectives

The specific objectives of session 2 were:

1. To give participants strategies for developing problem-solving skills using real life examples known to every elementary school student;
2. To develop team-efforts (cooperative learning efforts) in an elementary school classroom;
3. To develop the importance of estimation for elementary students; and

4. To allow participants to share ideas and to participate with their peers in cooperative efforts to improve teaching and learning.

Theoretical Assumptions

The procedures for this work session were again based on the findings of the Rand Change Agent Study, McLaughlin and Marsh (1978), which emphasized teacher involvement in staff development activities and the assumptions of Schofield (1981) that stressed learning takes place best in cooperative, threat-free environments.

Procedures

The following activities corresponded by number to the objective stated:

Activity 1--Word Problems For Early Grades. The researcher presented each participant with a booklet she had prepared on problem-solving for early grades using real-life situations. The researcher believed this could be a starting point to involve teachers in their own staff development. The participants discussed how to improve the booklet (see Appendix E-1).

Activity 2--Estimation. Teachers discussed how to apply estimation skills in the area of problem-

solving. The discussion that evolved was on how to allow students to work in groups, or pairs, of students on problem-solving estimation activities. The group discussed the possibility of allowing students to work independently on these activities, and then discuss their work in a group activity. The participants modified and added to the problem-solving booklet.

Activity 3--Sharing. Participants discussed how they planned to implement these activities in their own classrooms. All participants agreed to use this as a mini-unit. The researcher viewed this discussion as critical because a forum for discussion had not existed in the past for elementary school teachers to share their ideas with their peers.

Feedback Assessment Results

Item 1. Six participants responded in writing to the feedback assessment. Three rated the session as extremely useful (50%), two rated it as very useful (33%), and one rated it as somewhat useful (17%).

Item 2. In response to the activities found specifically practical, the number of participants responding to each item was:

Problem-solving for early grades--6

Estimation item--2

Talking with others--6

Item 3. The topics identified for exploration in future sessions were:

Problem-solving strategies--6

Computer utilization for early grades--3

Incorporating place value activities in a mathematics lesson--4

DeBerry Session 3

The third session at the DeBerry School was conducted as a continuation of the second session for a two-fold purpose. First, participants would learn problem-solving skills to develop in early-school students as well as review the previous session. Second, they would gather additional input and specific suggestions on how to implement these problem-solving skills into their mathematics curriculum. Additionally, the feedback data from the second session suggested that participants also wanted to review place value activities and how to begin to develop one's computer programming skills so that one would be confident in using computers with students.

On October 24, 1986 five participants including a mathematics resource teacher, a Chapter I mathematics/

language arts teacher, two bilingual teachers and a reading resource teacher gathered in the Chapter 636 computer lab at the DeBerry School. The third grade classroom teacher who had been the sixth member of this work session decided to drop out--stating parent conferences interfered with her participation.

The researcher believes that the Springfield Public School System must address this dilemma that many classroom teachers face by implementing a staff development program for elementary school teachers that would meet the teachers' needs.

Objectives

The specific objectives of session 3 were:

1. To review and develop problem-solving strategies;
2. To generate discussion on plans for incorporating workshop activities into instruction with students to enhance learning;
3. To illustrate for participants how computers work;
4. To instruct participants in BASIC language; and
5. To give participants hands-on experience using computers.

Theoretical Assumptions

The procedures for this work session were based on the findings of Campbell (1983); Saracho (1982); and Schofield (1981); which stressed the importance of interaction and communication between teacher-learner in the learning process; and on the research of Papert (1980); that states computer environments should be interactive environments.

Procedures

The following activities corresponded by number to the objectives stated:

Activity 1--Problem Solving. The first activity was devoted to a) a review of the problem-solving strategies covered in the previous session, and b) an introduction to other strategies for developing problem-solving skills in students.

Activity 2--To Generate Discussions. The dialogue that ensued centered around issues that were considered prerequisites for applying these problem-solving strategies with students to enhance learning. The participants discussed the possibility of using this problem-solving unit as a mini-unit, especially with Chapter I and bilingual students. The mathematics resource teacher stated that remedial students, who

are also Chapter I students, could benefit from this type of an approach. The mathematics resource teacher made the recommendation that the DeBerry Chapter I language arts/mathematics teacher and the two bilingual teachers might use these ideas with their mathematics students. The ideas presented in this unit suggested small groups, one-to-one instruction, and use of concrete materials in real life situations (see Appendix E-1). All participants planned to use this unit with their students because all participants believed that most students--Hispanic, Black, White--could benefit from the ideas discussed.

This discussion branched out into cooperative-learning situations in which students would work with a partner, or in a small group, as part of a mathematics activity. This approach has not been traditionally a part of a mathematics class. However, cooperative-learning situations are now regarded as an essential part of the mathematics learning experiences and one that maximizes the benefits of student exploration and discovery (Schoenfield, 1985). Building a student's self-confidence could be accomplished by actively involving students in their mathematics instruction; discovering mathematics concepts and communicating

their thinking to their peers could help any student in building his/her own self confidence. At this point in the discussion, the researcher introduced the possibility of using computers with Chapter I and/or bilingual students.

Activity 3--Introduction into Programming. The researcher made a presentation of how computers operated. The participants worked at computers a) to learn how to get on the system (user number, and password), and b) to learn how to exit the system. The researcher designed the remaining part of the workshop to place the participants in the role of the learner. The possible side effect would be to sensitize the participants to the learner's role in education.

Activity 4--Hands-On Activity With Computers. Working in pairs, the participants applied the following program procedures in BASIC: Let, Print, Read-Data, GoTo and Input. The participants concluded this session with a discussion on how to use computers in the immediate mode with their students. The participants stressed the importance of building a student's self confidence.

Feedback Assessment Results

Item 1. Five participants responded in writing to the feedback assessment. Four rated the session as extremely useful (80%), and one rated the session as very useful (20%).

Item 2. In response to the items found specifically practical, the number of participants responding to each item was:

Mathematics activities--3

Introduction to computers--5

Practicing statements in BASIC--5

Practicing screen formatting--2

Doing mathematical operations with computers--1

Talking with other staff members--1; and

Working with a partner--2

Item 3. The topic identified for exploration in future sessions was:

More programming.

This group of participants at the initial planning stages wanted an inservice training in mathematics. Now, however, they wish to focus on computers. The computers had been in use at the DeBerry School since 1983; however, these five participants had never had

the opportunity to use these computers. This workshop was scheduled for two hours. Due to lengthy discussions and active participation by each member, the session lasted for almost four hours.

DeBerry Session 4

By the fourth session on November 21, 1986, the researcher had met with the Supervisor of Mathematics and Computer Science, the Director of Federal Projects, the Assistant Superintendent of Instruction and Staff Development and the Deputy Superintendent as a planning session for the continuation of the present work sessions. Conversations and meetings with the aforementioned centered around a) obtaining funds for the teachers to continue participation, b) the need to continue developing staff member's computer abilities, c) the need for scheduling more computer activities other than CAI for students, d) the need to develop appropriate software to supplement the elementary curriculum, specifically in the area of language arts and mathematics, e) the need to establish a systematic way to train other staff members, and f) how to use this training process as a pilot project for future training on computers at the elementary level.

The researcher then met with the principals of the DeBerry and the Brightwood Schools to gather their input in this planning session. Each principal would support the proposal developed by the researcher to obtain additional funds for the continuation of these work sessions. However, one principal was uncertain about scheduling computer activities beyond CAI for students.

The researcher met also with the Director of Chapter I and the Coordinator of Chapter I language arts and mathematics to elicit their input concerning the need for inservice computer training system-wide for Chapter I personnel. As mentioned previously, the Chapter I staff had not received computer training since April 1985. Needs Assessment surveys conducted in April of 1986 and conversations and interviews with Chapter I staff reinforced the researcher's recommendation for the need for more training in the area of computer utilization. Furthermore, the present CAI for Chapter I students was not motivating Chapter I students to achieve at higher levels. Supplementing the present CAI program with mathematics and language arts activities developed by staff members could provide

the Chapter I student with appropriate computer experience to enhance learning.

The fourth session addressed the responses on the feedback assessment from the third session; namely, a continuation of programming including For-Next, If-Then, Read-Data statements. However, a portion of the fourth session involved a discussion specifically on the staff's concerns in this planning process.

Six participants including a Chapter I language arts/mathematics teacher, a reading resource teacher, two bilingual teachers, a first grade classroom teacher and the principal of DeBerry School met with the researcher in the DeBerry Chapter 636 computer lab. The mathematics resource teacher did not attend due to a death in the family. The first grade classroom teacher was new to the project.

Objectives

The specific objectives of session four were:

1. To review and expand on statements in the BASIC programming language;
2. To familiarize participants with how to structure and "debug" a program;
3. To begin to write and save programs in BASIC;

4. To generate discussions on plans for incorporating workshop activities into instruction with students to enhance learning; and
5. To discuss the planning process for the continuation of this project.

Theoretical Assumptions

The procedures for this work session were partially based on the work of Wood, Thompson and Russell (1981) which stressed the importance of teacher involvement in the planning of inservice education, and were partially based on the work of Lockheed et al., (1985) that illustrated the importance of allowing teachers enough time for computer training; and the work of Campbell (1983) that demonstrated that computers could enhance learning of teachers and students.

Procedures

The following activities corresponded by number to the objectives stated:

Activity 1--Review And Expand. In this activity, participants reviewed strings and their variables, the GoTo, Read-Data, If-Then, Statement in BASIC. The BASIC vocabulary was extended to include Rem statement

used in programming to describe parts of the program. Participants were also introduced to the For-Next and If-Then-Else statements.

Activity 2--Structuring A Program. The researcher explained how to write and how to "debug" a program. Working with a partner, participants entered a two-part multiplication and division program in the computer as the researcher explained line by line.

Activity 3--Writing And Saving Program. This activity required participants to write and save their own programs. The researcher explained how programs could be called up from one's own directory, how changes could be made in the program, and how the program could be renamed and saved. The participants completed this exercise by calling up a multiplication-division program from their own directory, added an additional section to this program, and then, renamed and saved this new program.

Activity 4--Discussion On How To Incorporate Workshop Activities With Students. The dialogue that generated centered around issues that were believed to be prerequisites in developing computer activities for students other than CAI. Participants in this workshop planned to develop programs that could supplement the

present Language Arts and Mathematics CAI Program. Participants also planned to use computers with their students in the immediate mode.

By introducing students to using computers in the immediate mode, the researcher believed that teachers would be more actively involved in the computer instruction with their students. Presently, the computer resource classroom teacher was responsible for all computer instruction at DeBerry School. Now, the computer resource teacher and the participants in the project would plan together to implement computer instruction more appropriate to student needs.

Activity 5--Discussion. The general discussion centered around the need to develop a plan which would provide additional training for the workshop participants. Participants listed possible outcomes from the additional training:

1. Teachers will feel adequately prepared to allow their students to use computers;
2. Teacher's attitude will change toward using computers in the service of instruction to produce favorable changes;
3. Teachers will be able to train other

teachers at their respective schools or at other schools; and

4. There could be established a systematic process for training all elementary school teachers on computer application other than CAI.

The discussion ended with all present agreeing that elementary school teachers could and should be exposed to the capabilities of computers.

Feedback Assessment Results

Item 1. Five participants responded in writing to the feedback assessment. Three rated the session as extremely useful (60%) and two rated the session as very useful (40%).

Item 2. In response to the items found specifically practical, the number of participants responding to each item was:

Review of previous programming skills--4

Practice statements in BASIC--2

Introduction to If-Then, For-Next statements--1

Talking with others--1

Working with others--2

Item 3. The topics identified for exploration in future sessions were:

More Programming

Additional discussion of the planning stages of the continuation of this project

DeBerry Session 5

By the fifth and final session on December 12, 1986, plans had been finalized by the researcher for a continuation of these work sessions. A significant number of participants indicated, in conversation with the researcher, the need for more information concerning the continuation of these work sessions. Therefore, an activity was included in this session in response to that suggestion. The feedback assessments continued to reflect a desire for more practice on writing programs that could be used as a supplement to the present CAI program. Therefore, the final session was devoted to writing a mathematics program in BASIC that would be appropriate to use with second, third or fourth grade students.

On December 12, 1986, seven participants, including the mathematics resource teacher, the Chapter I mathematics/language arts teacher, the reading resource teacher, two bilingual teachers, a first grade classroom teacher, and the principal of DeBerry School

gathered with the researcher in the Chapter 636 computer lab.

Objectives

The specific objectives for session five were:

1. To provide a review of the programming commands covered in the previous sessions and to apply these commands by revising a program;
2. To generate ideas for activities aimed at enabling an established school staff to modify computer utilization practices to bring about more effective use of computers in the area of mathematics and language arts; and
3. To finalize plans for the continuation of these work sessions.

Theoretical Assumptions

The procedures for the final work session at DeBerry school were based on the importance of teachers' involvement in staff development activities and the need for ongoing, continuous staff developmment activities (Berman and McLaughlin, 1978; McLaughlin and

Marsh, 1978; Phi Delta Kappan, 1980; Wood, Thompson and Russell, 1981).

Procedures

The following activities corresponded by number to the objectives stated:

Activity 1--Review. This activity was designed to review all programming commands previously covered. Participants completed review exercises including a) entering the system, b) reviewing key functions, c) calling up programs from their directory, d) modifying their old programs, and e) writing new programs in BASIC.

Activity 2--Future Planning. Participants collaborated on a plan to answer the following question "How can an elementary school staff modify computer utilization practice to bring about more effective use of computers in the area of mathematics and language arts?" Participants recorded possible activities to reach the goal. Collective responses were:

1. A teacher from this project would conduct a workshop for teachers at DeBerry School;
2. The focus would be on one particular grade level or group of students to modify computer instruction;

3. Additional training would be provided by the researcher to the presenter; and
4. Key personnel would be identified and involved as members of the project;
   a. principal,
   b. supervisor of computer and mathematics,
   c. project participants,
   d. computer lab teacher,
   e. other special teachers such a Chapter I teachers, Chapter 188 teachers,
   f. teachers,
   g. students.

Proposed action plan: The participants discussed the possibilities of the Chapter I staff at DeBerry School as the target group for the implementation of a modified computer utilization practice to bring about more effective use of computers for Chapter I students in the area of mathematics and language arts. The following, tentative plan was generated by means of open communications. Two participants of the project would 1) give a workshop to all other Chapter I staff of DeBerry Elementary School; 2) discuss plans with principal, Chapter I supervisors and Supervisor of Mathematics and Computers; 3) conduct workshop as part

of the Chapter I building meeting; 4) continue to provide staff support to Chapter I staff; and 5) implement modified, computer utilization practice with Chapter I students.

With this type of approach, it was suggested that: a) Chapter I students could benefit from computer utilization other than the drill and practice that they normally receive; b) Chapter I teachers' attitude could change toward using computers with Chapter I students to produce favorable changes; c) Chapter I teachers would feel adequately prepared to work with students at computers; d) Chapter I teachers could train other teachers at their school or at other schools (this could be one way to implement a computer training program for the Chapter I staff); and e) that following these sessions, another group of students or grade level would be the focus for modification of computer utilization.

Activity 3--Discussion. Participants discussed the continuation of these work sessions, where the workshop would be given, who would be involved, and what would be covered in these work sessions. After the workshop ended, four participants continued to practice writing programs in BASIC.

Feedback Assessment Results.

Item 1. Five participants responded in writing to the feedback assessment; one rated the session as extremely useful (20%) and four rated the session as very useful (80%).

Item 2. In response to the items found specifically practical, the number of participants responding to each item was:

Review of previous programming skills--1

Structuring a multiplication program--2

Talking with other staff members--1

Item 3. The topics identified for exploration of future sessions planned were:

Structuring spelling programs in BASIC

Continue to develop one's computer programming skills

Additional programming

Item 4. The following are a few responses to open comment:

"Thanks, your patience is great"

"The workshops were fantastic"

"I would like to continue to develop my programming skills."

Brightwood Session 1

As previously mentioned, the sessions at DeBerry Elementary School began on September 19, 1986; within one week, September 26, 1986, a concurrent session was also held at Brightwood Elementary School. On the latter date, eleven participants including a computer resource teacher, a bilingual teacher, a Chapter 188 resource teacher, three fourth grade teachers, four Chapter 1 mathematics/language arts teachers, and an assistant teacher in the Chapter 636 computer lab attended the initial planning session.

The objectives, theoretical assumptions and procedures for this work session were the same as the first session at DeBerry (see page 72); however, the outcome of the needs assessment survey and feedback results were specific for Brightwood.

Prioritizing Needs. The Brightwood group prioritized the needs according to individual needs. The following items were cited as pressing needs for the Brightwood school participants:

a.) Build teachers familiarity with computers doing hands-on activity--21

b.) Develop software--20

c.) Develop classroom activities appropriate to grade level in CAI--17

d.) Build computer skills in students by using off-computer activities--13

e.) Conduct a workshop in BASIC--13

f.) Offer a workshop to train staff in computer application--13

g.) Learn how to use computers with students in ways other than CAI--10

h.) Develop classroom activities appropriate to grade level in mathematics--8

i.) Learn how to write and run computer programs--7

j.) Develop seat work activities to integrate into computer time--5

k.) Use peer-tutoring in computer class--4

l.) Review the issues of mathematics and minorities--4

m.) Review the issue of mathematics and female antipathy--3

n.) Use peer-tutoring in mathematics class--3

o.) Using computers appropriately for drill and practice within the mathematics curriculum --2

p.) Help parents gain a better understanding of computers--1

q.) Learn about equity and computers--0

Working as a group, the participants began to develop an action plan for Brightwood School. The following items were cited as most urgent concerns:

1. To build teachers' familiarity with computers doing hands-on activities; and

2. To develop software (programs) that would be appropriate to use with students.

A long and short range goal for Brightwood School was established by open discussion.

Short Range

Conduct a workshop to train staff in how to use computers.

Long Range

Conduct workshops to train staff to program in BASIC.

The following beliefs gave direction to the activities that would be developed through this project.

Computers should be used in a school setting:

a.) To enhance student learning;

b.) To appropriate the student's ability;

c.) To ensure equity by providing equal access to computers for all students, regardless of sex, socio-economic status, and ability level; and

d.) To promote students' active participation in the learning process.

Feedback Assessment Results.

Item 1. Eleven of the participants responded in writing to the feedback assessment. Ten rated the session as extremely useful (91%) and one rated the session as very useful (9%).

Item 2. In response to the activities found specifically useful, the number of participants responding to each item was:

Time line for Brightwood School--9

Discussion on computer and mathematics issues--11

Needs assessment discussion--2

Needs assessment analyzing--5

Outline of plans--7

Item 3. The topics identified for exploration in future sessions and the number responding to each were:

Computer workshop--11

Off-computer activities--2

Developing appropriate software--10

Brightwood Session 2

Because the interest of the group at this point centered around teachers building their own familiarity with computers doing hands-on activities, the second session was devoted entirely to beginning programming in BASIC. The feedback from the first session and the dialogue from the first session served as the rationale for the second agenda to include programming. BASIC was chosen because equipment limitations at this time prohibited the use of other language such as COBOL, LOGO, or Pascal. In designing this workshop, the researcher kept in mind that research has demonstrated over and over again that when teachers are involved in formulating, developing and implementing change, the change efforts are most successful. The design of this workshop was to give teachers as much hands-on at computers as possible.

Two participants who had some previous experience in programming helped the researcher to involve the other participants in the activities of the workshop. The researcher met with these two participants

separately to discuss the possibility of their involvement in the second session. Both agreed to help the researcher in involving all participants with hands-on activities with computers.

On October 17, 1986, eleven participants, including a computer resource teacher, a bilingual teacher, a Chapter 188 resource teacher, three fourth grade teachers, four Chapter I language arts/mathematics teachers, and an assistant teacher gathered in the Chapter 636 computer lab at the Brightwood Elementary School. The teachers worked with a partner as the researcher conducted activities in BASIC in an effort to build teachers' familiarity with computers and build teachers' self-confidence in using computers with their students.

The objectives, theoretical assumptions and procedures for the second work session at Brightwood addressed computer utilization and were similar to the computer issues covered in the third work session at DeBerry (see page 83). The feedback assessment results are specific for Brightwood.

Feedback Assessment Results.

Item 1. Eleven participants responded in writing to the feedback assessment. Ten rated the session as

extremely useful (91%), and one rated the session as very useful (9%).

Item 2. In response to the activities found specifically practical, the number of participants responding to each item was:

Introduction to programming--8

Practicing the computer statements: Print, Run, End, Input, Read, Data, Let, If-Then--7

Screen formatting--5

Doing mathematical activities--5

Talking with others--3

Working with others--4

Other: Helping others--1

Item 3. The topics identified for exploration in future sessions were:

continue developing programming skills

begin to write programs

For-Next loops

Brightwood Session 3

The third session at the Brightwood school was conducted as a continuation of the previous session for a two-fold purpose. First, to provide participants with more experience in BASIC and to reinforce what

was learned from the last session. Second, to gather additional input and specific suggestions on implementation strategies for using the acquired basic programming skills with students. Additionally, the feedback data and dialogue from the previous session suggested that participants wanted more activities involving For-Next-Loops, and If-Then-Loops.

On October 29, 1986 the researcher met with the principal and the computer resource teacher at Brightwood School. This meeting was initiated by the researcher in an effort to involve teachers and students at Brightwood School in computer activities other than CAI. The results of this meeting served as the format for the activities in the third session. The scope of the activities was initially determined by the feedback results of the second session. However, the format of the activities was designed by the researcher and the computer resource teacher. The researcher and the computer resource teacher worked together to present the third session.

On October 31, 1986, eleven workshop participants and the principal of Brightwood School gathered with the researcher in the library of the Brightwood School. Workshop participants included a computer resource

teacher, a bilingual teacher, a Chapter 188 resource teacher, three fourth grade teachers, four Chapter I language art/mathematics teachers, and an assistant teacher.

The third work session at Brightwood was very similar to the fourth work session at DeBerry (see page 89); however, the open discussion and feedback assessment results are specific for Brightwood.

Open Discussion. The dialogue that ensued centered around issues that were believed to be prerequisite in developing computer activities for students other than in CAI. The existing format for scheduling students for computer usage had been for CAI only. This existing format for scheduling students did not promote teacher involvement. Teachers stayed with half of their group in the High I lab, which is next to the Chapter 636 computer lab, while the computer resource teacher worked with the other half. The existing system scheduled students twice a week for CAI--once for language arts/reading drill, and once for mathematics drill. The teachers in this workshop planned to work along with the computer resource teacher to implement computer activities other than CAI for their students. Students would be taught a) keyboard

skills, b) using computers in the immediate mode, c) arithmetic calculations, d) number variables and string variables, and e) simple sequencing strategies.

Students would continue to come to the Chapter 636 computer lab twice a week for CAI; however, programming skills would be initialized with some of the students. Only third and fourth grade students would be included in this phase since the participants in this session work with third and fourth grade students. Furthermore, the principal of Brightwood School preferred not to involve the lower grades.

By introducing the computer activities to students, the researcher believes that teachers would be more actively involved since they would be responsible for working along with the computer resource teacher in teaching these computer concepts. There was some discussion on whether or not further teacher training would be necessary. The group agreed that the next two sessions would be devoted to developing their own computer skills, and hopefully, through a funded work session, additional training could be given to this group of participants.

Feedback Assessment Results.

Item 1. Eleven participants responded in writing to the feedback assessment, and all eleven rated the session as extremely useful (100%).

Item 2. In response to the items found specifically practical, the number of participants responding to each item was:

Review of programming skills--8

Practicing previous skills--10

Introduction to "If-Then", "For-Next"--5

Talking with others--3

Working with others--4

Item 3. The topics identified for exploration in future sessions were:

More programming--10

Data statements

"If-Then" statements

One participant responded

I feel a lot more confident now--thanks

Brightwood Session 4

On December 5, 1986, thirteen participants, including a computer resource teacher, a bilingual teacher, a Chapter 188 resource teacher, three fourth

grade teachers, five Chapter I language arts/mathematics teachers, an assistant teacher, and the principal of Brightwood School gathered with the researcher in the library of the Brightwood Elementary School. The objectives, theoretical assumptions and procedures for the fourth session at Brightwood were the same as the fourth work session at DeBerry (see page 89) and served as a review for all previous procedures covered. The following feedback assessment results were specific for Brightwood.

Feedback Assessment Results

Item 1. Twelve participants responded in writing to the feedback assessment. Nine rated the session as extremely useful (75%) and three rated these session as very useful (25%).

Item 2. In response to the items found specifically practical, the number of participants responding to each item was:

Review of previous programming skills--9

Structuring a program--6

Writing and saving programs--9

Planning discussion--5

Talking with others--3

Working with others--5

Item 3. The topics identified for exploration in future sessions were:

Writing my own programs

Writing short programs for drill and practice

Developing the same great materials

Working with Input data on more than one line

Continue same procedure

Brightwood Session 5

On January 9, 1987 twelve participants including the computer resource teacher, a bilingual teacher, a Chapter 188 resource teacher, three fourth grade teachers, four Chapter I language arts/mathematics teachers, an assistant teacher, and the principal of Brightwood School gathered with the researcher in the library of the Brightwood Elementary School.

The objectives, theoretical assumptions and procedures for this work session were the same as the fifth work session at DeBerry (see page 96); however, the open discussion and feedback assessment results were specific for Brightwood.

Open Discussion. To generate a discussion on more teacher involvement in computer instruction. The participants discussed the possibility of answering

the following question, "How can an elementary school staff modify computer utilization practices to bring about more effective use of computers?" A proposed Action Plan for the Brightwood Elementary School was generated by means of open communication. Collective responses were 1) participants would work with the 636 computer resource teacher to implement keyboard activities and immediate mode activities with their students, 2) participants would also begin to implement programs they have written with their students, 3) off-computer activities would also be introduced to the students at Brightwood School (see Appendix H), and 4) fourth-grade students could be introduced to the Let and Print statements.

From this type of approach, it was suggested that a) students could benefit from computer utilization other than drill and practice; b) keyboard readiness, a need skill in the upper grades, could be introduced at an early age; c) teacher attitudes could change toward using computers with students to produce favorable changes; and d) teachers and students could work together and develop a positive learning environment for all students.

Feedback Assessment Results

Item 1. Eleven participants responded in writing to the feedback assessment; eight rated the session as extremely useful (73.%) and three rated the session as very useful (27%).

Item 2. In response to the items found specifically practical, the number of participants responding to each item was:

Reviewing of previous programming skills--6

Structuring a multiplication program--8

Planning discussion--2

Talking with other staff members--5

Working with other staff members--2

Item 3. The topics identified for exploration if future sessions were planned included:

Developing more mathematics programs

Developing more programs in spelling, language arts and reading comprehension for elementary school students

Developing a basic facts drill program

Item 4. The following are a few responses to open comment:

"I found that overall the program has covered all the areas that I had hoped it would cover,

and that, although the computer exposure has been limited, it has met my present needs. The workshop has been fun and worthy of my time."

"I enjoyed the workshop and would like to learn more about computers in order to be ready to use them in the school curriculum."

"As this was my initial exposure to computers, the sessions have been extremely useful. I can now program lessons for my students and am interested in a home computer for my personal use."

"This workshop has made me much more confident about computers and how to use them."

"The popularity of computers, and the obvious wide scale usage of them in the future should have piqued my interest. However, they scared me. When I had the opportunity to take part in Mrs. Ryczek's computer course, I learned that the "C" couldn't hurt me--but it certainly could help. Mrs. Ryczek has shown me some of the many uses of computers. She has done this in an interesting and relaxed manner. Mrs. Ryczek never once snickered, sneered or made a snide remark in reference to my performance,

which was pretty pathetic. Seriously, Mary, it was--you were great. Thanks."

Final Assessment

In January, 1987, all participants were asked to respond to a final assessment survey on the entire process. The first part of the survey required participants to rate the following on a scale of 1 (lowest) to 5 (highest):

Survey Part 1

1. The overall format of the session using hands-on experience with discussion of issues and planning activities

2. The process of using feedback from participants to plan subsequent sessions

3. The degree to which what was done in the session can be viewed as applicable to the classroom setting

4. The usefulness of what you learned to your understanding of computers

Survey Part 2

The second part of the final survey consisted of open comment to the following questions:

5. What specific ideas or approaches introduced in these sessions will you try in your instruction with the students?

6. Do you intend to apply what you have learned in your teaching? If so, how?

7. What do you feel was the most successful and/or least successful aspect of these sessions?

8. What were the most useful parts of these workshops?

9. What were the least useful parts of these workshops?

10. Do you have any further comments on the future of computers in the elementary schools?

Final Results

The six staff members at DeBerry School and the eleven staff members at Brightwood completed most of the sessions; of those, all participants from DeBerry and ten participants from Brightwood completed the

final assessment survey. The mean ratings for the first four items were as follows:

Table 1.

Survey Part 1-Ratings

		Mean Rating		
	Survey Item	DeBerry	Bright-wood	Average
1.	Overall format of sessions	4.3	4.6	4.45
2.	Process employed	4.3	4.6	4.45
3.	Applicable to classroom	4.3	4.4	4.35
4.	Usefulness of learning	4.2	4.2	4.2

Survey Part 2--Collective Summaries

5. What specific ideas or approaches will you try in your instruction with students?

Participants planned to implement the programming in BASIC with most of their students. Stating using computers for mathematics computation in the immediate mode during a mathematics lesson, participants hoped that this computer application could help to motivate students. Participants from both groups planned to use with their students the mathematics and language arts programs they had written (see Appendix G).

DeBerry participants planned to implement the problem-solving mathematics activities in their mathematics instruction.

6. How will you apply what you have learned in your teaching?

Most participants expressed a desire to introduce the computer concepts they had learned into their mathematics and language arts instruction with students. Many participants plan to have their students use computers in the immediate mode and some participants planned to introduce their students to programming in BASIC. Chapter I participants from both schools planned to use the skills learned to write programs to supplement the present CAI instruction that their students normally receive. Two participants from DeBerry who have already implemented a spelling program with their students, noted that students were motivated to do spelling and that students' skills in the area of spelling would improve. One participant stated, "I plan to try to instill in my students the computer confidence that I, myself, have gained through my participation in these work sessions. Introducing students to computer concepts step-by-step, in a manner

similar to the way I was introduced to computer concepts."

7. What do you feel was the most successful and/or least successful aspect of these sessions?

In general, the participants from DeBerry and Brightwood Schools stated that 1) the hands-on practice of computer concepts and, 2) the individual help as the most successful aspects of the workshops. Participants also stated the idea of working with others in small groups as being very beneficial. One participant stated, "the most successful aspect was getting teachers together to express needs and having them try to meet these needs". Another participant stated, "I feel the most successful part of the workshop was being able to work with others on group activities". And, finally, one participant stated, "The entire sessions were very successful." However, all participants agreed that the time allotment--from 1:15 p.m. until 3:00 p.m. was unrealistic--too short.

8. What were the most useful parts of these workshops?

All participants mentioned the hands-on practice and the one-to-one communication as the most useful

parts of these work sessions. Many participants stated the hand-out materials distributed at each session was extremely helpful and that these materials offered many ideas, which could be incorporated into their classroom activities.

9. What were the least useful parts of these workshops?

Many participants from both schools left this question blank or stated not applicable. However, some participants did state not enough time as the least useful part of this workshop.

10. Do you have any further comments on the future of computers at the elementary level?

Many of the comments addressed the computer's potential to individualize instruction and to motivate and enhance student learning. One bilingual teacher would like to see computers used in the bilingual component considering that the bilingual student could benefit from the type of instruction. Computers were viewed as a tool that could be used to challenge and motivate students. One participant wrote that the world is becoming highly computerized and it is crucial to begin using computers as early as possible in a

student's educational program. Generally, participants viewed the computer age as here to stay and envisioned computers placed in each classroom and not just in a computer lab. Computer training for teachers, as well as administrators, was viewed as essential in order to use computers more efficiently. One participant stated, "unless there are enough computer courses offered with teachers willing to attend, computers at the elementary level will not be used effectively".

Chapter V

Conclusions, Recommendations, and Implications

This study has discussed the relationship of research findings about effective staff development to school-based, collaboratively planned and implemented workshops in mathematics and computers in two urban elementary schools. This study looked at the changes in the participants' attitudes toward computers as a result of five workshops based on teacher needs. Based on the experiences and teacher assessments, certain conclusions were confirmed and some principles of effective staff development reported in the literature were supported as consistent with this study. Based on those findings, some recommendations are addressed to the Springfield Public Schools and other similar districts.

Current understanding of effective staff development approaches and actual practice in two urban elementary public schools differ in important ways. Nevertheless, this low-cost, voluntary project demonstrated that teachers want to participate in inservice workshops based on sound practices. Elementary teachers wanted to learn more about computers

and mathematics, several volunteered for workshops and they attended with positive evaluation.

Large urban school districts have difficulty figuring out how to implement staff development that is school-based, teacher-centered. Bureaucratic powers and teacher contract obligations limit staff development opportunities for many teachers. Yet, as this project demonstrated, the Springfield Public School System could and did provide support for teacher-centered voluntary staff development activities.

Main Question

What are the planning processes and procedures that enable teachers and other staff members to work together to plan and implement a staff development program in computer utilization and mathematics activities appropriate to their own individual needs and the needs of their students?

Based on experiences and insights gained from the planning procedures engaged in this study, the following conclusions are supported:

1. Staff development needs of individual teachers overlapped sufficiently so that school-based workshops could be planned and implemented for each group.

2. Dialogue among teachers, administrators and

other staff members promoted mutual adaptations toward curriculum improvement activities.

3. The principal's awareness to the initial planning procedure was critical to the success of these staff development activities. In these work sessions only two of the three principals who were involved in the initial steps agreed to allow the researcher to try and implement changes.

4. Support from the central office staff is essential for planning and implementing change, but that support will generally be limited to verbal approval, permission to proceed and some warnings about potential roadblocks such as union contract obligations or budgetary restrictions.

5. In building support for the proposed planning procedures communicating directly with teachers helped to build enthusiasm for this study. Communication with the Brightwood staff members on a one-to-one basis before the researcher began this process helped to increase voluntary participation.

6. Teacher involvement in establishing objectives for the proposed staff development activities was important for their participation. Allowing teachers to complete a needs assessment survey and then

developing a plan to address these needs illustrated to participants that their involvement was important.

7. Staff development should be school-based and on site. Each staff in the different buildings had different needs and rates of involvement.

8. When scheduled work sessions were longer than a month apart, reviewing previous lessons hindered progress.

9. Hands-on experiences and practice over a period of time reinforced adult learning. Although the first session started painfully slow, by the end of the sessions more than half of the participants were writing their own programs in BASIC.

10. Teachers discovered that successful change depends on their own efforts, but staff training and staff support helped initiate these change efforts.

The study concluded that teachers working together using the resources available, empowered themselves by identifying and prioritizing needs and then developing an action plan which met the objectives of the district's curriculum and operated in a coherent framework with a sound understanding of computer and mathematics education.

The following statements are supported by the literature reviewed and are consistent with the outcomes of this study.

1. The active involvement of principal and resource personnel in on-site staff development activities strengthened their roles as "instructional leaders" and informed teachers that staff development was important in their school.

2. The central office staff of the Springfield Public School System would encourage voluntary participation and the use of resources and materials in the building, but they would not encourage release time or any monetary incentives.

3. There must be on-site support for change efforts to be effective. The computer resource teacher extended the learning of the training sessions and responded to the teachers' needs as they arose by encouraging ongoing staff development support.

Subsidiary Questions

In an effort to sharpen the meaning of the major question, a number of subsidiary questions were considered.

Subsidiary Question--1

How do the principal, teachers, resource personnel, paraprofessionals, and students work together to develop meaningful computer experiences for all users?

The experiences and insights gained through the work sessions conducted in this study support the following conclusions.

1. Teachers' involvement in the planning and implementing phase of these work shops, including the selection of objectives, content, and activities helped to establish their participation. Both formal and informal feedback helped in planning each session.

2. Teachers in this study needed opportunities for hands-on experiences at computers with enough time to practice and apply skills that they have learned. Because of the lack of computer exposure by participants in this study, the beginning work sessions were set up at a very low level and proceeded a a very slow pace. Yet, by the end of the work sessions at each site, more than half of the participants could write programs in BASIC.

3. Hand-out materials showing all computer steps to be followed were an extremely important step for teachers in the learning process in this particular

study. Hand-out materials illustrating each step that was followed as learning took place allowed teachers to apply learned skills in their instruction with students.

4. School districts need to encourage principals, teachers, and other staff members in change efforts by providing release time, and inservice training for all staff members to interact. Scheduling remained a consistent problem throughout these work sessions.

The following statements are supported by the literature reviewed and are consistent with the outcomes of this study.

1. Clinical expertise exists within the staff. Following the conclusion of the study, follow-up sessions have been continued by those who have been involved from the initial steps.

2. A principal's presence and support of inservice training conveyed a message to staff members that ongoing staff development activities are important.

Subsidiary Question--2

> Are there factors in the school culture that inhibit or enhance the working relationships of the aforementioned?

The following conclusions are offered in evidence of the steps believed to have contributed to attaining a workable plan for these work sessions:

1. Initial dialogue focusing on identifying specific needs and establishing a workable plan to meet these needs was an important step in this process.

2. Initial dialogue with personnel in leadership positions, i.e., Deputy Superintendent, principals, and Supervisor of Mathematics and Computers, served to generate enthusiasm and build support for these work sessions.

3. Principals' input was necessary to supplement initial steps followed at each school site. Principals responded in different ways; each had their own leadership style.

4. Participants active involvement in workshop activities served as a means of establishing ownership for these work sessions. In the beginning of these work sessions the researcher presented most ideas and the teachers listened. However, by the final sessions at each school site teachers were actively involved in workshop presentations.

The following statement is supported by the literature reviewed and is consistent with the outcomes of this study.

1. Engaging participants in concrete activities and hands-on experiences with computers or with concrete examples in mathematics activities helped to make teachers more comfortable with their work.

Subsidiary Question--3

How do teachers build their own familiarity with computers in an effort to use computers effectively as a tool in the teaching process?

Based on experiences and insights gained through the staff development activities conducted in this study, the following conclusions are given.

1. Participants in this study needed computer experiences that included hands-on practice with computers and hand-out materials illustrating computer steps in an effort to apply learned skills in their instruction with students.

2. The Dolphin Software the teachers in this study are required to use with their students is a difficult system to learn. Computer inservice training would help teachers to better implement the Dolphin Software in their instruction with students.

Subsidiary Question--4

What do teachers do to ensure equity of computer instruction for all students?

At the beginning of this study, the researcher had planned to cover issues on race and gender in computer use and mathematics instruction. However, according to the needs of the participants in this study, this was not seen as a major concern. Participants in the study wanted staff development in computer utilization and mathematics activities. Therefore, equity concerns were not addressed.

The following statements are supported by the literature reviewed and are consistent with the outcomes of this study.

1. Realizing that males tend to be more active users of computers than females, teachers must make sure all students receive equal computer time.

2. Minority and female students need to become aware of career opportunities because computer skills can be translated into better job opportunities.

3. Positive role models must be provided for all students. Female and minority teachers should be

encouraged to teach computer classes, and guest speakers should include female and minority professionals in the computer field.

4. Computers help to improve the interpersonal cross-cultural, and cross-gender links among students.

5. Staff development for computer equity encourages professionalism in participants by drawing on their skills to shape educational uses of computers and by providing voluntary, tailored training options, feedback, and dissemination of information on computers and educational change.

6. Staff development for computer equity provides opportunity for participants to apply learned skills in their classrooms.

Subsidiary Question--5

> How can teachers motivate their students--especially minority and female students--to use computers and enhance student learning?

The conclusions maintain a focus on computer utilization, which exploit the best potential of computers and its capacity to enhance learning. Furthermore, the conclusions place learners in active rather than passive roles in relationship to computers. The conclusions strive to enable students to apply

computer technology to various subjects--especially mathematics and language arts--in the learning process. The following conclusions are based on experiences and insights gained through the planning and implementing of this study, the materials developed and the observations and suggestions of the participants, including the researcher.

Specific conclusions for computer utilization with elementary school students are as follows:

1. Integration of computers into the mathematics and/or language arts curriculums at the elementary school level can result in more individualized instruction for students and less whole-group instruction.

2. Teachers utilized cooperative learning or tutoring approaches in their own computer instruction and found those approaches less intimidating than a teacher-centered, test-driven approach.

3. Teachers and students need more than one session a week to develop their computer competency. Teachers, as well as students, need time to practice and build their own familiarity with computers. Students should be allowed to use computers at least twice a week for thirty minutes or more.

4. Teachers must learn how to use computers with students in other ways than CAI so that computer instruction will be appropriate to a student's individual needs. Students should be encouraged to use computers in the immediate mode. For example, students can work in pairs and use computers in the immediate mode as a calculator to do mathematics examples. Students in third and fourth grade should be allowed to do BASIC programming with Print, Input, and Let statements (see Appendix G).

The following statements are supported by the literature reviewed and are consistent with the outcomes of this study.

1. Teachers must feel comfortable working with students who have more knowledge about computers than they have.

2. Teachers in this study felt inadequately prepared to use computers in their classrooms. Teachers felt that despite inservice opportunities and available computer resource personnel, they wanted more time for hands-on experience to develop their own expertise.

Recommendations

Providing participants with support and ongoing training during computer activities were crucial determinants for success in this author's study. One of the most important findings derived from these staff development work sessions executed within two elementary urban schools was that staff development is an ongoing process. Schools and school systems need to develop new and creative ways to provide ongoing staff support for their teachers. System-wide inservice training sessions should be built into the yearly school schedule. Ten inservice days would allow for staff development to be offered to all staff members every month. Teachers who seek to meet the needs of a diverse student population must be encouraged through effective staff training activities and staff support activities.

Based on experiences, insights and activities conducted during five work sessions in two urban elementary schools, the following recommendations are supported.

1. There must be on-site support for change efforts to be effective.

2. Staff development activities should be part of a long-range plan tied into the participants' classroom goals. Currently, there are many models of staff development; however, one feasible model would be to use local personnel to offer staff development to other staff members who wish to attend. Long term substitutes could also be hired to free up teachers from their daily duties.

3. School districts should offer hands-on, school-based workshops by local school personnel to other staff members who want to participate.

4. Principals and other staff members, such as resource personnel and paraprofessionals, should be offered computer inservice training.

5. Release time during the school day would allow teachers to interact with other teachers and/or administrators to share ideas.

6. District-wide meetings should be established so that teachers, staff members, and principals could work together by grade level and subject content to implement computer activities into instruction with students (see Appendix D).

7. Share shops--open to all staff members on a voluntary basis could be one way of establishing a

school climate that encourages staff input. (Share shops are inservice training sessions in which each participant shares an activity that could be used with students.)

8. A monthly computer newsletter should be initiated so that ideas, activities, and suggestions could be disseminated.

9. School districts must provide teachers with inservice training in computer literacy in order to deal with the impact of computers on their lives and to keep pace with the inevitable sophistication of the students they work with.

10. Teachers must be given computer inservice training on an ongoing basis so that they will have a clear understanding of the various ways computers can be used, and will be able to integrate computers into the elementary curriculum.

11. Teachers at each school should work together to cover one another's classes so that all teachers would have free time to attend inservice training.

12. A computer resource teacher must be selected annually from the staff to work as a liaison between schools. This computer resource teacher would support

teachers at each school to plan and implement computer activities and to disseminate computer information.

13. Teachers should begin the use of computers as early as possible since gender and/or racial gaps begin to appear by the onset of puberty.

14. Teachers should assign female and /or minority students to help train younger students on computers. In this way, both students could develop self-confidence.

15. Teachers must develop classroom management skills in order to explore alternatives such as pairing students, working with small groups of students, or developing off-computer activities with their students during computer instruction (see Appendix H).

16. Teachers should develop programming skills in their students gradually. Introducing students to use the immediate mode should be a starting point.

17. Teachers should encourage students to learn programming skills at their own pace.

18. Teachers can emphasize the active nature of BASIC by illustrating that the students are in control of computers; that students teach computers rather than computers teaching the students.

19. Computer literacy will be so important in the future that all students should have experiences with the power of this tool.

Future Implications

One of the happiest outcomes of these work sessions is the continuation of this process. The school district was willing to offer an after school workshop with pay to participants who wished to continue. Participants are involved in a twenty hour paid workshop conducted by a local staff member. Hopefully, this process will continue and other elementary school teachers will be exposed to this type of experience.

Based on the results of activities conducted in the two urban elementary schools in this study, future staff development efforts in computer utilization should continue to be conducted at each elementary school in the Springfield Public School System. This would involve introducing staff members to computer utilization beyond CAI--currently the only application used at elementary schools. Because different school settings dictate different time frames at any point throughout the school year, workshops should be conducted. Primary plans would involve a workshop

facilitator. In most cases the computer resource teacher would learn the computer application with other staff members at the individual school. The next stage would involve workshops with teachers to learn the application; and, finally, implementation of computer application with students.

At each school, computer workshops should be conducted in BASIC, Computer Assisted Instruction, APL, Computer Management, Keyboard Application, or other computer application, based on each particular school's needs. New computer applications should continue to be introduced in each school based on an assessment of needs and discussion with principal and faculty. Assessment may be conducted on a formal basis with a needs assessment instrument; or on an informal basis by means of a discussion at a staff meeting. Principal and staff members would determine which application would be conducted. At the elementary school level, if microcomputers become available at individual schools, other software applications could also be introduced, such as Bank Street Writer, LOGO, etc.

Because teacher turnover, changes in grade level assignment, and the implementation of new programs

requiring additional teaching staff do occur, computer workshops should be part of each school's yearly plan for inservice staff training. These workshops would be offered as an introductory workshop to new teachers and as a refresher for other teachers. The present computer hardware utilized in this study requires a significant amount of time to learn. Ongoing staff development activities and staff support is necessary for teachers and other staff members to become skilled at using this computer system.

While the most widespread use of computers in urban schools thus far is probably for remediation in the form of drill and practice, many educators hope that the potential benefits of the computer will include raising basic skills. The potential for individualizing instruction and using learning approaches that are highly interactive means that computers could change the dynamics in the classroom--improving teacher expectations of students and student expectations of themselves.

Computers, alone, will not solve all the problems urban schools face. With or without computers, urban schools face the issues that have long been central to the struggle for equal access to quality education.

The challenge for the urban school system, however, is to find ways to use computers to improve the education for all students, regardless of race, gender, previous experience, or ability level. After many years of only limited progress with conventional approaches to providing quality educational services to disadvantaged students, the hope is that computers will galvanize new and vigorous reform efforts in urban schools.

Perhaps, the opportunity for less teacher-centered classrooms, the opportunity for more teacher-student working together, collaborative planning, and helping one another in classrooms, could be accomplished through computer use. Staff development will have to be part of that change.

Computers have the potential to change the dynamics of education. Either their use will reinforce inequities that favor White, male, middle class students and schools or they will begin to open opportunities for females, minorities and low-income students and schools. Given the attitude and resource currently exhibited in urban elementary schools, educators will have to support a strong, sustained, well thought-out staff development program along the lines described in this study if the second possibility is to become a reality.

References

Ahl, D. (1981). Computers in Mathematic Education. Editorial. Mathematics Teacher. 74, 588-89.

Aiken, L. R. (1976). Update on Attitudes and Other Affective Variables in Learning Mathematics. Review of Educational Research, 46(2), 293-311.

Anderson, R., Welch, W., & Harris, L. (1984). Computer Inequities in Opportunities for Computer Literacy. The Computing Teacher, 11(8), 35-44.

Anderson, R., Klassen, D., Krohn, K., & Smith-Cunnien, P. (1982). Assessing Computer Literacy: An Empirical Assessment Final Report. St. Paul, MN: The Minnesota Educational Computer Consortium.

Anick, C. M., Carpenter, T. P., & Smith, C. (1981). Minorities and Mathematics: Results from the National Assessment of Educational Progress. Mathematics Teacher, 74, 560-66.

Becker, H. J. (1986a). Instructional Uses of School Computers: Reports from the 1985 National Survey. Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.

_____. (1986b). Microcomputers in the Classroom Dreams and Realities. Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.

_____. (1985a). How Schools Use Microcomputers Summary of the 1983 National Survey. Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.

_____. (1985b). The Second National Survey of Instructional Uses of School Computers; A Preliminary Report. Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.

_____. (1984). School Use of Microcomputers Reports from a National Survey (Issues 1-6). Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.

Bell, E. (1980). CAI and Computer Literacy: A Ten Year School University Project. St. Louis, MO: Association for Educational Data System.

Benbow, C., & Stanley, J. (1980, January). Sex Differences in Mathematical Ability Fact or Artifact? Science, pp. 1262-64.

Bentzen, M. M. (1974). Changing Schools: The Magic Feather Principle. New York: McGraw-Hill.

Berman, P., & McLaughlin, M. W. (1978). Federal Programs Supporting Educational Change Vol. VIII: Implementing and Sustaining Innovations. Santa Monica, CA: Rand Corporation.

_____. (1975). Federal Programs Supporting Educational Change Vol. IV: The Findings in Review. Santa Monica, CA: Rand Corporation.

Bibisi, S. (June 3, 1985). High School Girls Shown Superior at Computer Programing. Education Daily, p. 3.

Bloom, B. S. (1984). The Search For Methods of Group Instruction as Effective As One-to-One Tutoring. Educational Leadership, 41, 1-10.

_____. (1976). Human Characteristics and School Learning. New York: McGraw-Hill.

Bogart, K. (1984). Toward Equity: An Action Manual for Women in Academia. Washington, DC: Association of American Colleges.

Bork, A. (1985). Personal Computers for Education. New York: Harper and Row.

_____. (1984). Computers in Education Today and some possible futures. Phi Delta Kappan, 66(3), 239-243.

Brush, L. E. (1980). Encouraging Girls in Mathematics. Cambridge, MA: Abt. Books.

Burns, M. (1986). Teaching What to Do in Arithmetic vs. Teaching What to do and Why. Educational Leadership, 43(6), 34-38.

Burns, P. K., & Bozeman, W. C. (1981). Computer-Assisted Instruction and Mathematics Achievement: Is there a Relationship? Educational Technology, 21(10), 32-39.

Buxton, L. (1981). Do You Panic About Mathematics? London: Heinemann Educational Books.

Cambre, M. A., & Cook, D. L. (1985). Computer Anxiety: Definition, Measurement, and Correlates. Journal of Educational Computing Research, 1(1), 37-54.

Campbell, P. (1986). What's A Nice Girl Like You Doing In a Math Class? Phi Delta Kappan, 67(7), 516-519.

_____. (1983, Spring). Computers and Children: Eliminating Discrimination Before It Takes Hold. Equal Play, pp. 5-7.

Caporael, L., & Thorngate, W. (1984). Introduction: Towards the Social Psychology of Computing. Journal of Social Issues, 40(3), 1-13.

Carey, P. (1977). Engineering Education and the Black Community: A Case for Concern. Journal of Negro Education, 46, 39-45.

Castaneda, A. M. (1980). Research questions in Mathematics Learning by Minority Group of Children. In Salient Issues in Mathematics Education Research for Minorities. Washington, DC: Institute of Education. (ERIC Document Reproduction Service No. ED 191 699).

City University of New York. (1983). The Urban Project Report: Minority Students Advancement in Science and Technology. New York: Author.

Clarke, V. (1986). Girls and Computing: A Study of Primary School Children. Paper presented at the American Educational Research Association. San Francisco, CA.

Cole, D. D., & Hannafin, M. J. (1983). An Analysis of Why Students Select Introductory High School Computer Coursework. Educational Technology, 23(4), 26-31.

Coleman, J. S. (1976). Differences Between Experiental and Classroom Learning. In M. Keeton (Ed.), Experiental Learning Rational, Characteristics and Assessment (pp.49-61): San Francisco: Jossey-Boss.

Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., and York, R. L. (1966). Equality of Educational Opportunity. Washington, DC: U. S. Department of Health, Education and Welfare.

Crist-Whitzel, J., Dasho, S. J., and Beckum, L. C. (1984). Achieving Equity: Student Led Computer Training. Paper presented at the Annual Meeting of the American Educational Research Association. San Francisco, CA.

Dede, C. (1983). The Likely Evolution of Computer Use in Schools. Educational Leadership, 41(1), 22-24.

_____. (1981). Educational Social and Ethical Implications of Technological Innovations. Programmed Training and Educational Technology, 18(4), 210-215.

Delseni, D. (1984). Local School Response To Computer Equity. The Computing Teacher, 11(4), 68-69.

Deringer, D. K. (1983). New Directions for Education. Educational Leadership, 42, 25.

Edmonds, R. (1982). Programs of School Improvement: An Overview. Educational Leadership, 31(1), 4-11.

_____. (1979). Effective Schools for Urban Poor. Educational Leadership, 38, 15-27.

_____. (1978). Evaluation of Circle Incorporate Carnegie Project to Improve Reading Skills of Black Children. Washington, DC: Institute of Education. (ERIC Document Reproduction Service No. ED 155 344).

Edneier, H., Good, T. L. (1979). The Effects of Instructing Teachers About Good Teaching on the Mathematics Achievement of Fourth Grade Students. American Educational Research Journal, 16, 1-16.

Education Week. (March 23, 1983). Computers. p. 8.

_____. (May 11, 1983). Math and Science Improvements Must Involve Female and Minority Students. p. 24.

Edwards, J. B. (1980, February). Delivery Systems for Computer Technology. AEDS Monitor, pp. 5-10.

Edwards, J., Norton, S., Taylor, S., Weiss, M., Dusseldorp, R. (1975). How Effective is CAI? A Review of Research. Educational Leadership, 33, 147-151.

Elliott, P. (1983). Question: Is Math Anxiety a Figment of the Imagination? Answer: Never. International Journal of Mathematical Education In Science and Technology, 14(6), 777-785.

_____. (1974). Elementary Mathmematics Teacher Training via a Programming Language. (Doctoral dissertation, University of Massachusetts, 1973). Dissertation Abstract International, 35, 297A.

Entwisle, D. R., and Baker, D. P. (1981). Young Childrens Expectations for Performance in Arithmetic. Unpublished manuscript, Johns Hopkins University, Center for Social Organization of Schools, Baltimore.

Erickson, T. (1986). Off and Running The Computer Offline Activities Book. Berkeley, CA: Equals in Computer Technology, Lawrence Hall of Science.

Fennema, E. (1981). The Sex Factor in Elizabeth Fennema. (ed). Mathematics Education Research Implications for the 80s. Reston, VA: National Council of Teachers of Mathematics.

Fennema, E., and Sherman, J. (1978). Sex Related Differences in Mathematics Achievement and Related Factors: A Further Study. Journal For Research in Mathematics Education, 9, 189-203.

Gerard, R. W. (1967). Computers and Education. New York: McGraw-Hill.

Ghory, W. J., & Cash, K. (1981). Improved Teaching in Urban Classrooms: Applying More Precise and Demanding Standard. Washington, DC: National Institute of Education.

Gilliland, K. (1986). Curriculum Development for Equity in Computer Education. Paper presented at the World Congress on Education and Technology. Vancouver, British Columbia, Canada.

_____. (1984). Equals in Computer Technology. The Computing Teacher, 11(4), 42-44.

Goodlad, J. E. (1984). A Place Called School: Prospects for the Future. New York: McGraw-Hill.

_____. (1975). The Dynamics of Educational: Change Toward Responsive Schools. New York: McGraw-Hill.

Grace, G. (1978). Teachers, Ideology and Control: A Study In Urban Education. Boston: Allyn & Bacon.

Gressard, C., & Loyd, B. H. (1984, April). An Investigation of the Effects of Math Anxiety and Sex on Computer Attitudes. Paper presented at the meeting of the Annual Meeting of the American Educational Research Association, New Orleans, LA.

Griswold, P. A. (1982). Longitudinal Patterns of Student Attitudes in a Computer Assisted Instruction Curriculum Part 5 in Ragosta, M., Holland, P. W., and Jamison, D. Computer Assisted Instruction and Compensatory Education, The ETS/LAUBD Study Final Report. Princeton, NJ. Educational Testing Service.

Gussett, J. C. (1980). Ghetto Children and Mathematics. Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No. ED 120 276).

Hall, K. A. (1974). Inservice Mathematics Education for Elementary School Teachers via Computer Assisted Instruction. Educational Technology, 14(4), 59-61.

Hart, H. A. (1974). Self-Renewal: A Model. Educational Leadership, 31(1), 499-501.

Harvey, G. (1986). Finding Reality Among the Myths: Why What You THought About Sex Equity in Education Isn't So. Phi Delta Kappan, 67(7), 509-512.

Heckman, P., Oakes, J., & Sirotnik, K. (1983). Expanding The Concepts of School Renewal and Change. Educational Leadership, 40(7), 26-32.

Hess, R. P., & Miura, I. (1985). Gender Differences in Enrollment in Computer Camps and Classes: The extra curricular acquisition of computer training. Sex Roles: A Journal of Research, 13(3/4), 193-203.

Instructional Technology A Book of Readings. (1968). Frederick G. Knirk and John W. Childs (Eds.). New York: Holt, Rinehart & Winston.

Jackson, K. W. (1982). Achievement differences in mathematics: A search for casual explanation. Paper presented at the meeting of The National Council of Black Studies, Department of Sociology, Rice University, Houston, TX.

Jamison, D., Suppes, P., & Wells, S. (1974). The Effectiveness of Alternative Instructional Media: A Survey. Review of Educational Research, 44(1), 1-61.

Johnson, J. P. (1892). Can Computers Close the Educational Equity Gap? Perspectives: The Civil Rights Quarterly, 14(3), 20-25.

Johnson, M. L. (1984). Blacks in Mathematics: A Status Report. Journal for Research in Mathematics Education, 15(2), 145-153.

Jones, B. L. (Ed.). (1972). Urban Education: The Hope Factor. Philadelphia: Sauders.

Joyce, B., & Showers, B. (1980a). Transfer of Training: The contributions of coaching. Journal of Education, 63(2), 163-172.

_____. (1980b). Improving In-Service Training The Message of Research. Educational Leadership, 37, 379-385.

Kapel, D. E., & Kapel, M. B. (1980). Bureau For School Improvement in Cooperation with the Educational Forum Branch of the Horace Mann Learning Center. Washington, DC: Institute of Education. (ERIC Document Reproduction Service No. ED 219 482).

Kogelman, S., & Warren, J. (1978). Mind Over Math. New York: The Dial Press.

Kotlowitz, A. (September 16, 1985). The Computer Generated Gap. The Wall Street Journal, p. 52.

Kraus, W. H. (1981). Using A Computer Game to Reinforce Skills in Addition Basic Facts in Second Grade. Journal For Research in Mathematics Education, 12(2), 152-55.

Kulik, J., Bangert, B., & William, G. W. (1983). Effects of Computer-Based Teaching on Secondary School Students. Journal of Educational Psychology, 75,(1), 19-26.

Kulik, C., & Kulik, J. (1984). Effects of Computer Based Education on Elementary School Pupils. Paper presented at The American Educational Research Association, New Orleans.

Kulik, C. L., Kulik, J., & Cohen, P. (Winter, 1980). Effectiveness of Computer-Based College Teaching: A Meta Analysis of Findings. Review of Educational Research, 50(4), 524-44.

Kvarnes, R. G. (1980). Manual: Institute for Study of Anxiety in Learning. (Available from [Robert G. Kvarnes Washington, DC.]).

Lawrence, G. (1974). Patterns of Effective Inservice Education. Tallahassee, FL: Florida Educational Research & Development Program.

Lazuvus, M. (1974, Jan./Feb.). Mathophobia: Some Personal Speculations. National Elementary Principal, 53, 16-22.

Leacock, E. B. (1969). Teaching and Learning in City Schools: A Comparative Study. New York: Basic Books.

Leinhardt, G. (1986). Expertise in Mathematics Teaching. Educational Leadership, 43(6), 28-33.

Lezotte, L. W. (1980). Effective Teacher Training and Urban School Improvement. Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No. ED 207 949).

Lieberman, A., & Miller, L. (1984). Teachers Their World and Their Work. Implications for School Improvement. Alexandria, VA: Association for Supervision and Curriculum.

_____. (1978). Staff Development New Demands, New Realities, New Perspectives. New York: Teachers College Press.

Lipkin, J. (1984). Computer Equity and Computer Educators (You). The Computing Teacher, 11(4), 19-21.

_____. (1983). Equity in Computer Education. Educational Leadership, 41(1), 26.

Little, J. W. (1981). School Success and Staff Development in Urban Desegregated Schools. Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No. ED 205 628).

Lockheed, M. (1985). Women, Girls and Computers: A First Look at the Evidence. Paper presented at the Annual Meeting of the American Association for the Advancement of Science. Los Angeles, CA.

Lockheed, M., Thorpe, M., Brooks-Guinn, J., Casserly, P., & McAloon, A. (1985). Understanding Sex/ Ethnic Differences in Mathematics, Science and Computer Science for Students in Grades Four to Eight. Princeton, NJ: Educational Testing Service.

Loucks, S. F., & Hall, G. E. (1977). Assessing and Facilitating The Implementation of Innovations. Educational Technology, 17(2), 18-21.

Lytle, D. (Jan. 29, 1986). Texas School Tackles Academic Changes with Computers. Education Computer News, p. 10.

Mattaliano, P. A. (1982). Self-help for Teachers Collegial Supervision in Urban Schools. Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No. ED 234 114).

Matthews, W., Carpenter, T. P., Lindquist, M. M., & Silver, E. (1984). The Third National Assessment: Minorities and Mathematics. Journal for Research in Mathematics Education, 15(2), 165-71.

Matthews, W. (1984). Influences on the Learning and Participation of Minorities in Mathematics. Journal for Research in Mathematic Education, 15(2), 84-95.

_____. (1983). Coloring the Equation: Minorities and Mathematics. Journal For Research in Mathematics Education, 14(1), 70-72.

_____. (1981a). Black Females & Mathematics Barricade or Bridge. Journal of Social & Behavioral Science, 27, 88-92.

_____. (1981b). Race and Sex Related Differences in High School Mathematic Enrollment. (Doctoral dissertation, University of Chicago, 1980). Dissertation Abstracts International, 41, 3934A.

McLaughlin, M., & Marsh, D. (1978). Staff Development and School Change. Teacher College Record, 80(1), 69-94.

McCormick, W. (1979). Teachers Can Learn To Teach More Effectively. Educational Leadership, 37, 59-60.

Menosky, J. (May, 1984). Computer Workshop. Science, p. 40.

Mevarech, Z., & Rich, Y. (1985). Effects of Computer Assisted Mathematics Instruction on Disadvantaged Pupils' Cognitive and Affective Development. Journal of Educational Research, 79(11), 5-11.

Meyers, R. A. (1980). Attitudes of Elementary Teachers Towards Mathematics. Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No. ED 190 388).

Miller, L., & Wolf, T. (1978). Staff Development for School Change: Theory and Practice. In A. Lieberman and L. Miller (Eds.), Staff Development: New Demands, New Realities, New Perspectives. (pp. 144-166) New York: Teachers College Press.

Miura, I. T., & Hess, R. D. (1984). Enrollment Differences in Computer Camps and Summer School. The Computing Teacher, 11(4), 22-26.

Molnar, A. R. (1978). Computer Literacy in the Classroom. The Journal, 5, 35-38.

Moore, E. G. J., & Smith, A. W. (1985). Mathematics Aptitude Effects of Coursework, Household Language and Ethnic Differences. Urban Education, 20(3), 273-94.

National Commission for Employment Policy. (1985). Uses of Computers in Education. Washington, DC: National Commission for Employment Policy.

National Commission on Excellence in Education. (1983). A Nation at Risk. The Imperative for Educational Reform. Washington, DC: Secretary of Education, U. S. Department of Education.

National Council of Supervisors of Mathematics. (N.C.S.M). (1978). Position paper on basic mathematics skills. Mathematics Teacher, 71, 147-152.

National Council of Teachers of Mathematics (N.C.T.M). (1986). Professional Development for Teachers of Mathematics A Handbook. Reston, VA.

_____. (1981). Guidelines for the Preparation of Mathematics. Reston, VA.

_____. (1980). An Agenda for Action - Recommendation for School Mathematics. Reston, VA.

_____. (1979). An In-Service Handbook for Mathematics Education. A. Osborne (ed). Reston, VA.

Nicholson, A. M., Joyce, B., Parker, D. W., & Waterman, F. T. (1976). The Literature on In Service Teacher Education (STE) Report 3. Palo Alto, CA: National Center for Educational Statistics and the Teacher Corps.

News notes. (1984). States taking more active role in school use of microcomputers. Phi Delta Kappan, 66, 301-303.

Nye, S. (1986). Teaching What to do in Arithmetic vs. Teaching What to do and Why. Educational Leadership, 67(7), 34-38.

Oettinger, A. O. (1969). Run, Computer Run: The Mythology of Educational Innovation. Cambridge: Harvard University Press.

Ortiz-Franco, L. (1981). A Synthesis of Selected Research of NIE in Mathematics Education Related to Minorities. Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No. ED 210 154).

Pallas, A. M., & Alexander, K. L. (1983). Sex Differences in Quantitative SAT Performance New Evidence on the Differential Course Work Hypothesis. American Research Journal, 20, 165-82.

Papert, S. (November 1986). Just a Computer. Elementary Principal, 66(2), 49-50.

_____. (April 1984). New Theories for New Learning. Paper presented at the Conference of the National Association of School Psychologists. Washington, DC.

_____. (1980). Mindstorms: Children, Computers and Powerful Ideas. New York: Basic Books.

PEERS National Center for Computer Equity. (1986). Debugging the Program: Computer Equity Strategies for the Classroom Teacher. Washington, DC: National Center for Computer Equity.

_____. (1984). Sex Bias at the Computer Terminal How Schools Program Girls. Washington, DC: National Center for Computer Equity.

Phi Delta Kappa. (1980). Why Do Some Urban Schools Succeed? The Phi Delta Kappa Study of Exceptional Urban Elementary Schools. Bloomington, IN: Phi Delta Kappa.

Pitschka, R., & Wagner, W. (1981). Uplifting Math Scores. Classroom Computer, 2(2), 20.

Purkey, S. C., & Smith, M. (1983). Effective Schools: A Review. The Elementary School Journal, 83(4), 428-452.

Quality Education Data. (1984). The 1983-84 Microcomputer Usage in School Survey. Denver, CO.

Ragosta, M., Holland, P., & Jamison, D. (1982). Computer Assisted Instruction and Compensatory Education The EST/LAUSD Study Final Report. Princeton, NJ: Education Testing Service.

Reisner, E. R. (1983). The Use of Computers in Instruction Supported Under Chapter I of the Education Consolidation and Improvement Act. Washington, DC: Policy Studies Association.

Resnick, L. B. (1985). Cognition and the Curriculum. Paper presented at the Annual Meeting of the American Educational Research Association. Chicago, IL.

Reyes, L. H., & Stanic, G. M. (1985). A Review of the Literature on Blacks and Mathematics. Paper presented at American Educational Research Association. Washington, DC.

Richard, F., & Suinn, R. (1972). The Mathematics Anxiety Rating Scale: Psychometric Data. Journal of Counseling Psychology, 19, 551-54.

Riedesel, C. A. (1980). Teaching Elementary School Mathematics (3rd ed.). New Jersey: Prentice Hall.

Rubin, L. (Ed). (1979). Improving In-Service Education. Boston: Allyn & Bacon.

Rubin, R. (1986). Designing and Implementing a Staff Development Project For Microcomputer Utilization To Enhance Learning in Three Public Elementary Schools. Unpublished doctoral dissertation, University of Massachusetts, MA.

Ruddell, A. K., & Balow, I. (1963). Evaluation of An In-Service Arithmetic Program. Journal of Educational Research, 57, 34-38.

Rounds, J. B., & Hendel, D. D. (1980). Mathematics Anxiety and Attitudes Towards Mathematics. Measurement and Evaluation in Guidance, 13, 83-89.

Sadker, M., & Sadker, D. (1986). Sexism in the Classroom: From Grade School to Graduate School. Phi Delta Kappa, 67(7), 512-15.

Saracho, O. N. (1982). The Effects of Computer Assisted Instruction Program in Basic Skills Achievement and Attitude Toward Instruction of Spanish Speaking Migrant Children. American Educational Research Journal, 19, 201-19.

Sarason, S. B. (1982). The Culture of School and the Problem of Change (2nd ed). Boston: Allyn & Bacon.

Schofield, H. L. (1981). Teacher Effects on Cognitive and Affective Pupil Outcomes in Elementary School Mathematics. Journal of Educational Psychology, 73, 462-471.

_____. (1976). Attitudes Towards Mathematics. School Science and Mathematics, 6, 469-476.

Schubert, T. G., & Bakke, T. W. (1984). Practical Solutions To Overcoming Equity in Computer Use. The Computing Teacher, 11(4), 28-30.

Scott-Jones, D. & Clark, M. L. (1986). The School Experience of Black Girls: The Interaction of Gender, Race and Socioeconomic Status. Phi Delta Kappan, 67(7), 520-26.

Sells, L. W. (1978). The Forum: Mathematics A Critical Filler. Science Teacher, 45(2), 28-29.

Sepie, A. C. & Keiling, B. (1978). The relationship between types of anxiety and under-achievement in mathematics. Journal of Educational Research, 71, 15-19.

Shakeshaft, C. (1986). A Gender At Risk. Phi Delta Kappan, 67(7), 499-502.

Shavelson, R., Winkler, J., Stasz, C., Feibel, W., Robyn, A., & Shaha, S. (1984). Teaching Mathematics and Science Patterns of Microcomputers Use. Santa Monica, CA: Rand Corporation.

Sheingold, K. (1981). Issues Related to the Implementation of Computer Technology in Schools (Technical Report No. 1). New York: Bank Street College of Education, Center for Children and Technology.

Sheingold, K., Martin, L. & Endreweit, M. (1985). Preparing Urban Teachers for the Technological Future (Technical Report No. 36). New York: Bank Street College of Education, Center for Children and Technology.

Sheingold, K., Hawkins, J., & Char, C. (1984). I'm The Thinkest, You're The Typist: The Interaction of Technology and The Social Life of Classrooms. Journal of Social Issues, 40(3), 63-76.

Sheingold, K., Kane, J. & Endreweit, M. (1983). Microcomputer Use in Schools: Developing a Research Agenda. Harvard Educational Review, 52(4), 412-421.

Shumway, R. J. (Ed.). (1980). Research in Mathematics Education. Reston, VA: National Council of Teachers of Mathematics.

Simon, M. (1986). The Teacher's Role in Increasing Student Understanding of Mathematics. Educational Leadership, 43(6), 40-43.

Smith, B. E. (1975). Improvement of Inservice Education: A Collaborative Effort. In R. A. Edelfelt & M. Johnson (Eds.). Rethinking Inservice Education. Washington, DC: National Education Association.

Smith, I. D. (1973). Impact of CAI Instruction on Student Attitudes. Journal of Educational Psychology, 64(3), 366-71.

Sturdivant, P. (1984). Access to Technology: The Equity Paradox. The Computing Teacher, 11(4), 65-67.

Suydam, M. (1984a). What Research Says: Micro-computers and Mathematics Instructions. School Science and Mathematics, 84(4), 337-43.

_____. (1984b). What Research Says: Helping Low-Achieving Students in Mathematics. School Science and Mathematics, 84(5), 437-41.

Taylor, R. (ed). (1980). The Computer in the School: Tutor Tool, Tutee. New York: Teacher College Press.

Tishler, A. (1980). A Study of Attitude Treatment Interaction in Mathematics with Pre-Service Elementary School Teacher. Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No. ED 195 400).

Tobias, S. & Weissbroad, C. (1980). Anxiety and Mathematics: An Update. Harvard Review, 50, 63-70.

Tobias, S. (1978). Over Coming Math Anxiety. New York: W & W Norton & Co. Inc.

Turkington, C. (1985). Computers in Class: Who Gets to Learn. Washington, DC: Peer National Center for Computer Equity.

U. S. News & World Report. (Jan. 8, 1979). As Computers Start To Transform Schools. pp. 39-40.

Vinsonlaler, J. F., & Bass, R. R. (1972). A Summary of Ten Major Studies on CAI: Drill and Practice. Educational Technology, 12(7), 29-32.

Watson, N. D. (1982). Microcomputers in Education Uses of the 80s. Proceeding of the Annual Micro Computer Conference. (ERIC Document Reproduction Service No. ED 233 696).

Watt, D. (1982). Education for Citizenship in a Computer Based Society in Computer Literacy. R. Seidel (ed). New York: Academic Press.

White, K. (1982). The Relationship Between Socio-economic Status and Academic Achievement. Psychological Bulletin, 91, 461-81.

Williams, R. C. (1979). A Political Perspective on Staff Development. Teachers College Record, 80(1), 95-106.

Wilson, M. A. B. (1983). Teachers, Microcomputers and Inservicing. Journal of Staff Development: Staff Development for Computer Literacy, 4(2), 80-92.

Winkle, L. W., & Matthews, W. M. (1982). Computer Equity Comes of Age. Phi Delta Kappan, 63(5), 314-15.

Wong, R. E., Uhrmacher, B., & Siegfreid, D. (1984). Computers and Equity: A Pilot Program. The Computing Teacher, 11(4), 52-55.

Wood, F. H., Thompson, S. R. & Russell, F. (1981). Designing Effective Staff Development Programs. In Staff Development/Organization Development (pp. 59-89). Alexandria, VA: Association for Supervision and Curriculum Development.

Wood, F. H., & Thompson, S. R. (1980). Guidelines For Better Staff Development. Educational Leadership, 37(5), 374-78.

Zucker, A. A. (1982). The Computer in The School. A Case Study. Phi Delta Kappan, 63(5), 317-19.

Appendixes

Appendix A

NEEDS ASSESSMENT SURVEY

Appendix A

NEEDS ASSESSMENT SURVEY

- Build your own familiarity with the computer doing hands-on activities.
- Develop your own software.
- Workshop in learning BASIC.
- Workshop to train staff in computer application.
- Develop classroom activities appropriate to your grade level in computer assisted instruction.
- Learn how to use the computer with students in ways other than CAI.
- Develop classroom activities appropriate to your grade level in mathematics.
- Promotion of more active teacher involvement.
- Observe other teachers using computers.
- Learn about equity and computers.
- Review the issue of mathematics and minorities.
- Review of issues of mathematics and females.
- Use the computer appropriately for drill and practice within the mathematics curriculum.
- Develop seat work activities to integrate into your computer time.
- Use peer-tutoring in your computer class.
- Use peer-tutoring in your mathematics class.
- Help parents gain a better understanding of the importance of mathematics.
- Help parents gain a better understanding of computers.

- Build computer skills in students by using off computer activities.
- Observe other teachers during a mathematics lesson.
- Learn how to write and run a simple program.
- Other: 1.

  2.

  3.

  4.

Appendix B

DeBERRY FEEDBACK ASSESSMENT

BRIGHTWOOD FEEDBACK
ASSESSMENT

Appendix B-1

DeBERRY FEEDBACK ASSESSMENT

Session 1

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful	1	2	3	4	5	Extremely Useful

2. I specifically found practical:

   a. Outlining plans for activities

   b. Discussion on computer and mathematics issues

   c. Needs assessment discussion

   d. Needs assessment analyzing

   e. Time line discussion

   f. Talking with staff members

   g. Other: _____

3. In a future session I would like to investigate

_____

Appendix B-2

DeBERRY FEEDBACK ASSESSMENT

Session 2

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

   Not Useful _____ Extremely Useful
   1 2 3 4 5

2. I specifically found practical:

   a. Problem solving for early grades

   b. Estimation items

   c. Talking with staff members

   d. Other: _____

3. In a future session I would like to investigate

_____

_____

_____

Appendix B-3

DeBERRY FEEDBACK ASSESSMENT

Session 3

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful					Extremely Useful
1	2	3	4	5	

2. I specifically found practical:

   a. Mathematics activities

   b. Introduction into programming

   c. Practicing statements in BASIC: Let, Print, Read, Data, GoTo, Then and Input

   d. Practicing screen formatting

   e. Doing mathematical operations on a computer

   f. Talking with other staff members

   g. Working with a partner

   h. Other: _____

3. In a future session I would like to investigate

_____

_____

_____

Appendix B-4

DeBERRY FEEDBACK ASSESSMENT

Session 4

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful _____ Extremely Useful

1 2 3 4 5

2. I specifically found practical:

   a. Review of previous programming skills

   b. Practicing statements in BASIC: Let, Print, Read, Data, GoTo, Then and Input

   c. Introduction of If-Then, For-Next statements

   d. Talking with other staff members

   e. Working with a partner

   f. Other: _____

3. In a future session I would like to investigate

_____

Appendix B-5

DeBERRY FEEDBACK ASSESSMENT

Session 5

I would like your frank assessment of all activities completed in order to report accurately on how this process can be useful.

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful	1	2	3	4	5	Extremely Useful

2. I specifically found practical:

   a. Review of previous programming skills

   b. Structuring a Multiplication program

   c. Planning discussion

   d. Talking with other staff members

   e. Working with a partner

   f. Other: _____

3. If a future session were to be planned, I would like to explore _____

_____

4. Open Comments: _____

_____

_____

Appendix B-6

BRIGHTWOOD FEEDBACK ASSESSMENT

Session 1

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful					Extremely Useful
1	2	3	4	5	

2. I specifically found practical:

   a. Outlining plans for activities

   b. Discussion on computer and mathematics issues

   c. Needs assessment discussion

   d. Needs assessment analyzing

   e. Time line discussion

   f. Talking with staff members

   g. Other: _____

3. In a future session I would like to investigate

_____

Appendix B-7

BRIGHTWOOD FEEDBACK ASSESSMENT

Session 2

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful						Extremely Useful
	1	2	3	4	5	

2. I specifically found practical:

   a. Introduction into programming

   b. Practicing statements in BASIC: Let, Print, Read, Data, GoTo, Then, and Input

   c. Practicing screen formatting

   d. Doing mathematical operations on a computer

   e. Talking with other staff members

   f. Working with a partner

   g. Other: _____

3. In a future session I would like to investigate

_____

_____

_____

Appendix B-8

BRIGHTWOOD FEEDBACK ASSESSMENT

Session 3

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful					Extremely Useful
1	2	3	4	5	

2. I specifically found practical:

   a. Review of previous programming skills

   b. Practicing statements in BASIC: Let, Print, Read, Data, GoTo, Then and Input

   c. Introduction of If-Then, For-Next statements

   d. Talking with other staff members

   e. Working with a partner

   f. Other: _____

3. In a future session I would like to investigate

_____

Appendix B-9

BRIGHTWOOD FEEDBACK ASSESSMENT

Session 4

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful					Extremely Useful
1	2	3	4	5	

2. I specifically found practical:

   a. Review of previous programming skills

   b. Structuring a program

   c. Writing and saving programs

   d. Planning discussion

   e. Talking with other staff members

   f. Working with a partner

   g. Other: _____

3. In a future session I would like to investigate

_____

Appendix B-10

BRIGHTWOOD FEEDBACK ASSESSMENT

Session 5
January 9, 1986

I would like your frank assessment of all activities completed in order to report accurately on how this process can be useful.

1. On a scale from 1 (not useful) to 5 (extremely useful) what would be your overall rating of the session.

   Please place an X in one of the five spaces in the continuum below.

   a. not useful

   b. minimally useful

   c. somewhat useful

   d. very useful

   e. extremely useful

Not Useful	1	2	3	4	5	Extremely Useful

2. I specifically found practical:

   a. Review of previous programming skills

   b. Structuring a multiplication program

   c. Planning discussion

   d. Talking with other staff members

   e. Working with a partner

   f. Other: _____

3. If a future session were to be planned, I would like to explore_____

_____

_____

4. Open Comments:_____

_____

_____

Appendix C

FINAL SURVEY

Appendix C

FINAL SURVEY

You have been very instrumental in planning and implementing these workshops in your school. Based on your own participation in these workshops, please rate questions 1-4 from 1 (lowest) to 5 (highest) as each question pertains to your participation in these workshops.

Please circle one number

Lowest	1	2	3	4	5	Highest				
1.	The overall format of the session using hands-on experience with discussion of issues.					1	2	3	4	5
2.	The process of using feedback from participants to plan subsequent sessions.					1	2	3	4	5
3.	The degree to which what was done in the sessions can be viewed as applicable to the classroom setting.					1	2	3	4	5
4.	The usefulness of what you learned to your understanding of computers.					1	2	3	4	5

Please answer the following questions in the space provided.

5. What specific ideas or approaches introduced in these sessions will you try in your instruction with students?

6. Do you intend to apply what you have learned in your teaching? If so, how?

7. What do you feel was the most successful and/or least successful aspect of these sessions?

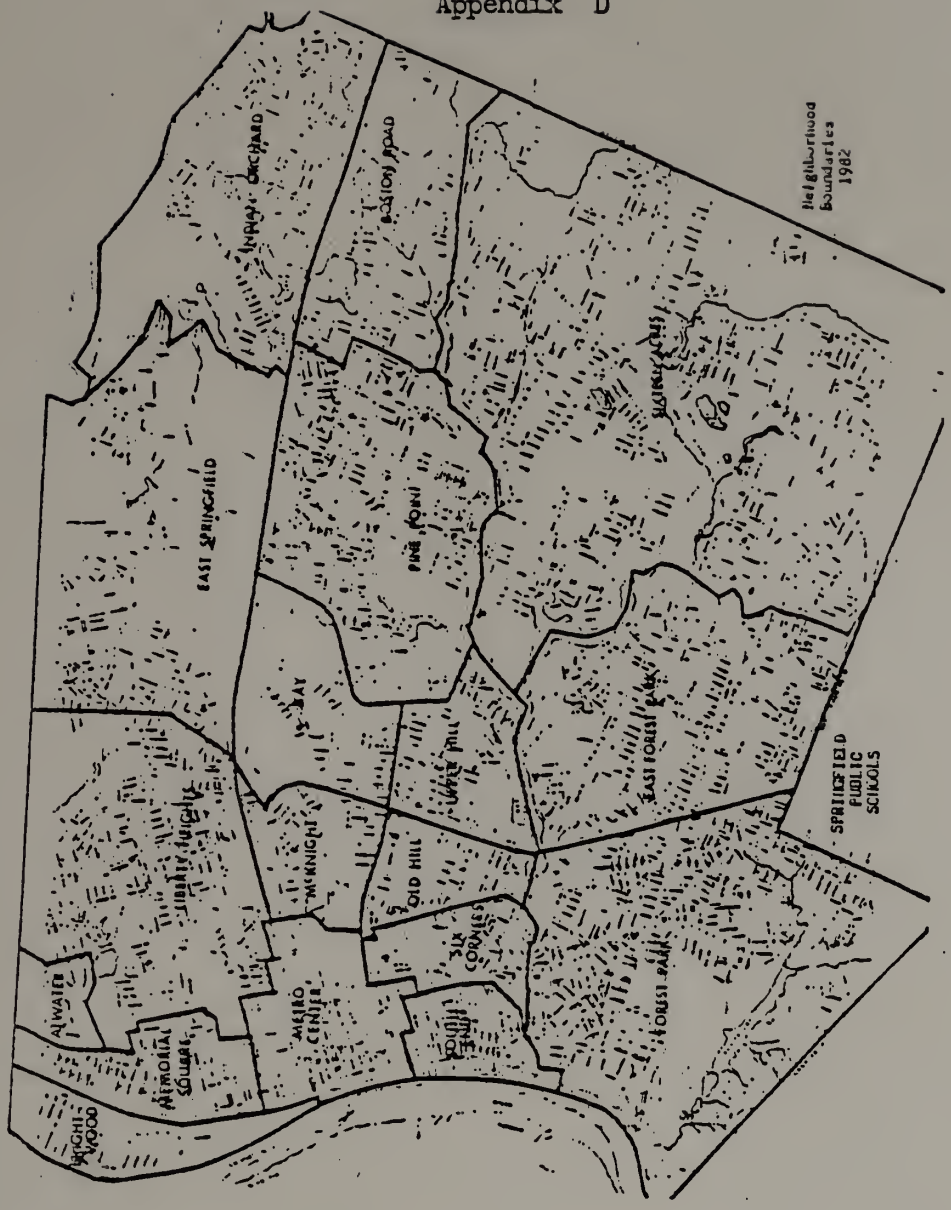
8. What were the most useful parts of these workshops?

9. What were the least useful parts of these workshops?

10. Do you have any further comments on the future of computers in the elementary public schools?

Appendix D

Appendix D


Neighborhood Boundaries 1982
INDIAN ORCHARD
BOSTON ROAD
PINE POINT
EAST SPRINGFIELD
BLUNTS KNOLL
EAST FOREST PARK
SPRINGFIELD PUBLIC SCHOOLS
OLD HILL
SIX CORNERS
MEMORIAL SQUARE
METRO CENTER
BRIGHTWOOD

Appendix E

Appendix E-1

SOLVING WORD PROBLEMS--Early Grades

This packet on word problems has been designed by DeBerry Staff Members to use with students who have acquired addition and subtraction skills in grades 1, 2, and 3.

Objective

Using previously acquired addition and subtraction skills, the student will translate word problems into math sentences and solve them.

1. Key Words

   Given word problems with key words, the student will match key words with the correct operational sign.

2. Implied Key Words

   Given word problems with implied key words, the student will select the correct mathematical sentence.

3. Using Data Correctly

   Given word problems with and without key words, the student will select the appropriate data, write a math sentence and solve the problem.

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3. Using Data Correctly

   Given word problems with and without key words, the student will select the appropriate data, write a math sentence and solve the problem.

VOCABULARY

WORDS WE WILL USE IN THIS LEARNING UNIT:

operational sign - means + (plus), and - (minus)

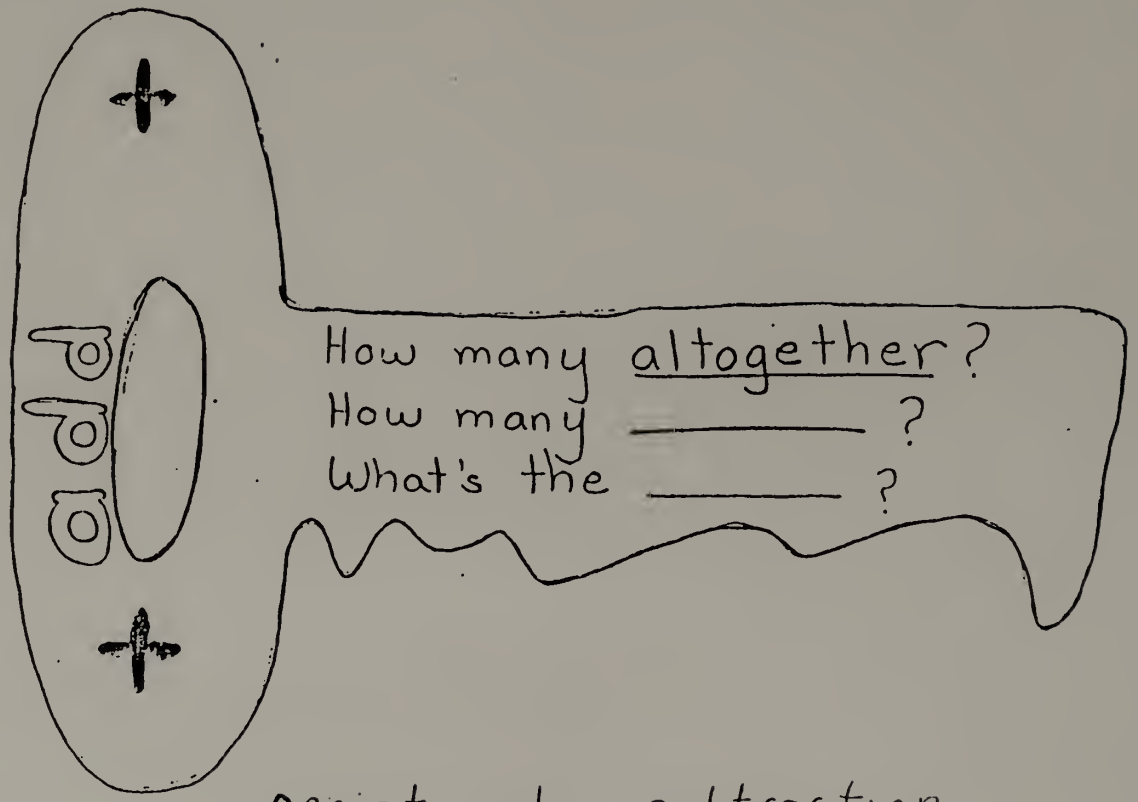
mathematical sentence - the numbers and signs used to solve the word problem. All math sentences have an equal sign. ex. 4 + 5 = 9, 17 - 8 = 9

key words - the words that tell us to add or subtract in the word problem.

question sentence - a group of words that asks a question and ends with a (?) question mark. Key words are found in the question sentence.

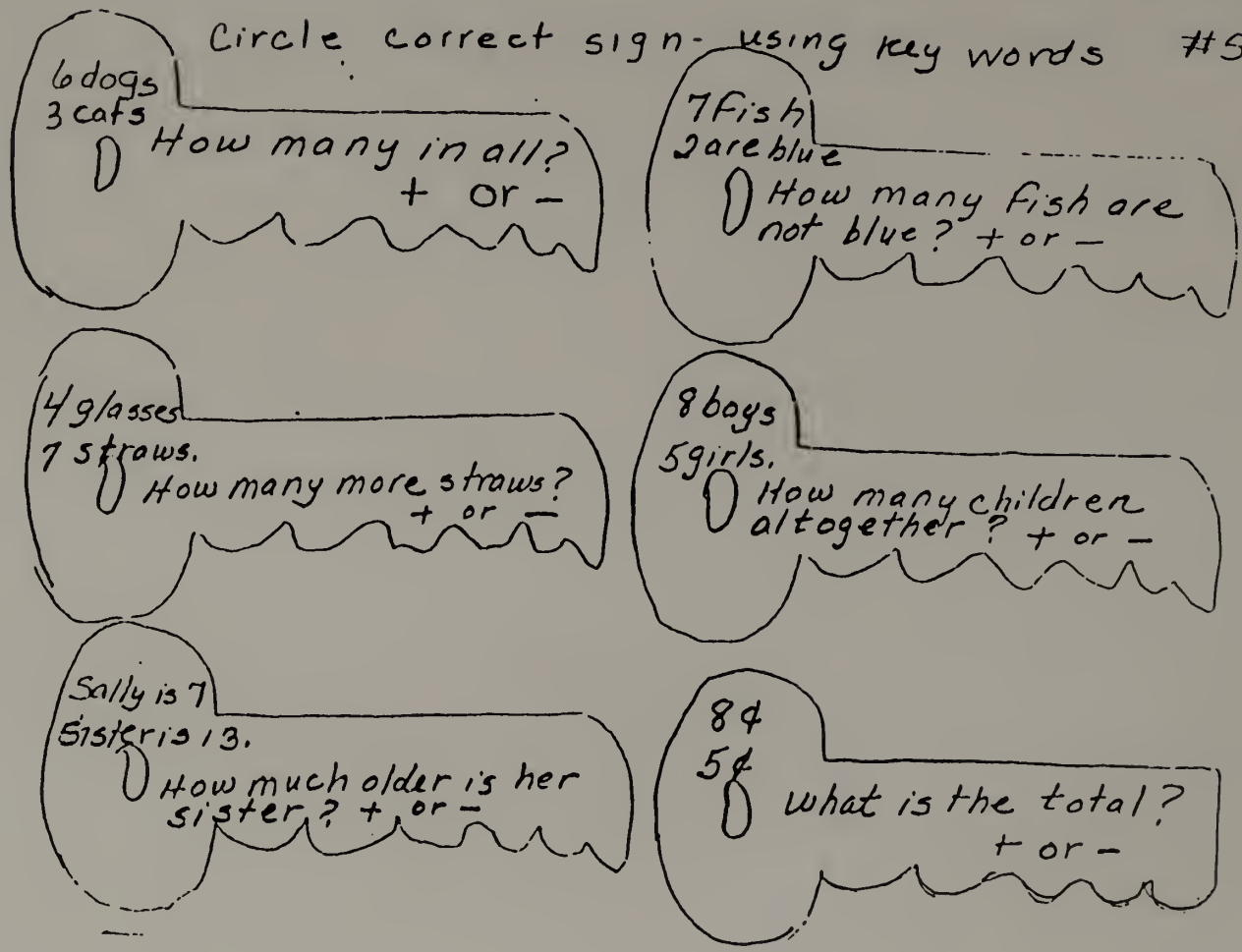
CUES FOR UNIT STRATEGIES ARE:

1. When teaching addition, stress the joining of sets to make a whole.
2. When teaching subtraction, stress that a whole is broken into its parts.
3. Teach How many more is a comparison. The question to be asked after the comparison is matched is, "How many are left?".
4. Make a list of comparative words--note "or".
5. Teach children to use manipulatives, or draw pictures, when doing problems.
6. Reteach what a question is and how it ends with a question mark (?).
7. In a subtraction problem, BIG NUMBER is written first.
8. Have students circle, or underline, data.
9. Provide a chart for math vocabulary.
10. Provide each child with key outline so that he can record keywords for addition--subtraction on opposite side.



Opposite side - subtraction

Circle correct sign- using key words #5



Sample Page

Name _____ Finding Key Words for add.

Circle question sentence in each word problem. Underline key words and put in the correct sign

1. 8 dogs
   5 cats
   How many animals in all? ____

2. Ate 4 apples
   1 orange. How much did I eat altogether? ____

3. Had 5¢
   Earned 5¢ more
   What is the total? ____

4. Saw 9 boats
   I can How many things
   I'm all? ____

5. 6 boys . 7 girls
   What is the total? ____

6. 5 cows
   6 horses
   How many animals altogether? ____

7. Took 5 books he then took 7 more.
   How many books in all ____

8. Sang 1 song today
   Yesterday sang 7 songs
   How many songs altogether? ____

Name: ?

No Key Words

1) Jane ate 6 bugs. Then she ate 3 more. How many bugs did she eat?

6+3= 6-3=

2) Jane had 5 pets. Then I ran away. How many does she have now?

5+1= 5-1=

3) Sue spend 5¢ for a pencil. She spend 4¢ for a paper. How much did she spend?

5+4= 5-4=

4) Saw 10 birds. (Flew away. How many birds stayed?

10+6= 10-6=

5) 10 boys playing 4 boys sitting. How many are there?

10+4= 10-4

6) Joan had 8¢ She Found 10¢

How much does she have now

8+10= 10-8=

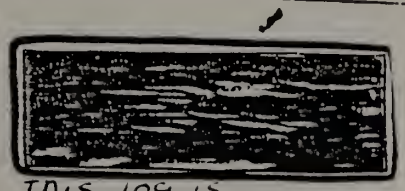
Key words
for subtraction

Comparing -
How many more?

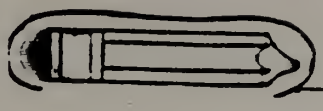
How many more circles than triangles? ____ .

Some comparing words.

tall taller"
big _____ .
small _____
old _____
near _____
long _____
short _____



this log is _____ .



This pencil is _____ .

II - SUBTRACTION

AMUSEMENT PARK

Materials: Large sheet of paper, marker, play money, game markers and two dice.

Directions: Players take turns drawing an amusement park game board with things to buy and riders to ride (use odd amounts 22¢, $1.47, etc.). The banker (leader) gives each player $20 worth of play money. Players throw two dice and move around the game board. When the player lands on a ride or food booth that he/she want to "go on" or "eat", she/he pays for the ride or food and tells the banker how much change he/she needs back. Incorrect "telling" loses a turn. Winner is the first to spend exactly $20.00.

MINUS RELAY

Materials: Numbered (playing) cards, scrap paper, pencils and a clock

Directions: Place number cards face down on the table. Starting with the number 100. Each player, in turn, turns over a card and subtracts it from the running total. The team with the least time wins.

MATH-O-MINUTE

Materials: Any Game Board, four dice, and markers

Directions: Player throws four dice. Player picks three dice to add together and one dice to subtract from the total. Player then moves his/her marker the amount remaining.

III - MULTIPLICATION

"HUSKER DU 1"

Materials: Make pairs of cards such as [2 X 4], [8], etc.

Directions: Place the cards face down on the table after mixing them up. First player turns up a card and trys to find the card with the matching answer. If there is a match, the player keeps the cards. If there is no match the card is again placed face down on the table. Player with the most cards at the end of the game wins.

IV - DIVISION

Materials: Make pairs of Division Cards such as [3|6], [2], etc.

Directions: Same as "HUSKER DU 1".

FAMILY MATH-GAMES

MATERIALS- All found in the home: gameboard, scrap paper, playing cards, play money, dice, magic markers.

1 - ADDITION

MATH-O-CHASE

Meteriels: Any Interaction Game Board, game markers, 2 to 4 dice.

Directions: Players throw two to four dice, add up the numbers, and move the total sum of the dice.

MATH RELAY

Materials: Ten numbered (playing) cards and a watch with a second hand.

Directions: Place cards face down on a table about 15 feet from the players. Leader turns over a card. Player runs up to the table and flips over two additional cards. Player adds up all three cards, calls the correct sum, and runs back to the line. The whole group competes against the clock.

TIC-TAC-TOE

Materials: Four dice, Tic-Tac-Toe Game papers and pencils.

Directions: A player calls out ODD or EVEN, rolls all four dice, and adds up all the dice. If the player has called ODD(EVEN) and the sum is ODD(EVEN) the player is allowed to make an X or O on the Tic-Tac-Toe game paper.

"ESP"

Materials: Face Cards (J=1, Q=2, K=4)

Directions: Place cards face down on the table. Leader turns over the first card. The player guesses if the next card will be red or black. Player keeps turning over cards until she/he has made three correct guesses. Player then calls out the correct sum of the three cards. Players could be asked to guess the face of the cards and the values could be changed.

BINGO

Materials: Ten dice and Bingo cards

Directions: Players make their own 5 X 5 cards using numbers 10 to 60 (Center Free). Each player rolls 10 dice, adds the faces and covers the sum if shown on his/her card. Winner covers a line of numbers.

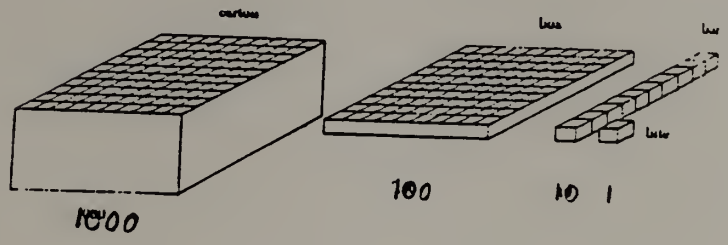
Appendix E-3

PLACE VALUE

Knowledge of place value is important to an understanding of the algorithms of addition, subtraction, multiplication, and division and to the later development of decimals and percent. A lack of understanding of such procedures as regrouping in addition and subtraction originates from a lack of understanding of place value.

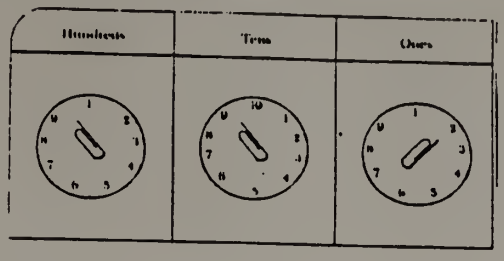
It is the responsibility of the children's first teacher to develop and understanding of place value and that of succeeding teachers to deepen this understanding.

A laboratory approach can be used with the concept of a chocolate or candy factory, in which bites (ones) of chocolate are thought of as being put in a machine and coming out in the form of bars (tens) and bites (ones). From this, it is possible to move to boxes (100s) and later to cartons (1,000s). Candy can be represented by duplicated squares ½" X ½" for bites, ½" X 5" for bars, and 5" X 5" for boxes. Or else marbles, or paper or plastic bags, of two sizes can be used.



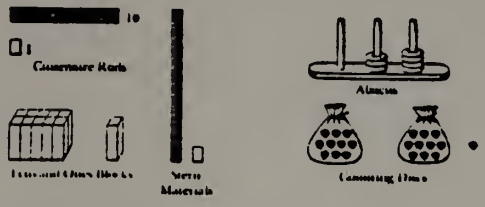
Also, children can have experience buying and selling at a classroom store in which all the money is dollars, dimes, and pennies.

When some place-value understanding has been developed, duplicated sets of dials can be used with paper-clip spinners to generate numbers to be written or substituted in a place-value frame.



A game can be played using this device. Two children each spin a number and record the number. The child who has the larger number scores a point if he or she has named the number correctly. The game can be played equally well with three or four children.

Devices such as Cuisenaire rods, tens and ones blocks, Stern materials (strips of ten and single squares), counting discs in plastic bags, and a simple abacus may also be used.



As children in succeeding grades mature in their understanding of the number system, first expanded notation and then exponents are used to continue work on place value.

Appendix F

Computer Users Guide &
Vocabulary

VOCABULARY

A Computer is a machine that accepts information, processes it according to specific instructions, and provides the results as new information.

Software - the coded instruction which direct the computer how to process information

Hardware consists of a Central Processing Unit (CPU) main memory, various input/output devices, and storage devices.

Instructions are executed one at a time in the CPU while the main memory stores data, other instructions and calculates results.

Input/output devices enable user to enter information into the computer and receives the processed results.

A Program is a sequence of specific instructions that informs the computer of the tasks which the user wants it to perform.

RAM Random Access Memory; memory which can be written or erased and re-programmed.

ROM Read Only Memory; permanent information and instructions that is built-in to the computer at the time of manufacture, cannot be erased during normal operations.

Line Numbers each line must begin with a number.
ex. 10, 20,

Print statement is used to print both words and numbers. There are two basic types of information which the computer can utilize: numbers and words.

Run - the command Run is typed after a program has been entered to execute the program, but is not part of the program.

Hardcopy a printed paper copy of a computer program.

List this command is used to print the program correctly in the computers memory.

example:
a. List + Return = entire program
b. List# + Return = line # only
c. List#20-40 + Return = list lines in program from 20-40

End - every program must have one end statement as its highest numbered instruction to inform the computer that the program is complete.

Variable is a symbol that may assume many different values.

example:
at line 20 x = 7
line 50 x = 12

Sring Variable assigns words.

example:

```
10 AS = "Harry"
50 AS = "Sherry"
```

Harry will be replaced with Sherry

Read Statement instructs the computer to read data.

Data Statement instructs the computer what the data for particular program is.

Goto tells the computer where to go.

example:

```
10 Read X, Y, Z,
Do Print 2*X+3*Y+8*Z
25 Goto 10
30 Data 3, 2, 4
End
```

Input - allows user to introduce data.

example:

```
10 Input X
20 Print 5*X*X+3*X+2
30 Goto 10
40 End
```

Commas and Semicolons are used in print statements to instruct the computer how to arrange output.

Appendix G

Computer Booklet

```
NEW
5 Print "TYPE IN YOUR NAME"
10 Input N$
20 data 2,3,4,5,2,3,3,7,3,3,8,2,4,5,2,8,3,10, 5
30 for T=1 to 9
35 Read A,B
40 print
50 Print , "TYPE IN YOUR ANSWER ," N$
60 print
70 Print , A "X" B "="
80 Input "              ";AN
90 Print
100 If AN=A*B
110 If AN<>A*B then GOTO 245
120 CA=CA+1
130 GOTO 250
245 Print ,  "WRONG"
250 Next T
255 Print , "YOUR SCORE    "  N$  ","  "IS"  CA   "OUT OF 9"
260 end

Run


NEW
10 Print , "TYPE IN YOUR NAME"
20 INPUT N$
30 Data 2,4,2,6,2,2,2,7,2,5, 2,9,2,1,2,3,2,8
40 Data 5,1,5,8,5,7,5,5,5,2,5,6,5,9,5,4,5,3
50 FOR T = 1 TO 18
60 PRINT
70 Print , "TYPE IN YOUR ANSWER ," N$
75 PRINT
80 PRINT A "*"B"="
85 INPUT "        "; AN
90 Print
100 IF AN=A*B THEN PRINT            "RIGHT"
110 IF AN<>A*B  THEN GOTO 245
120 CA=CA+1
130 GOTO 250
245 Print . "WRONG"
250 Next T
255 PRINT , "YOUR SCORE "N$  ","  "IS"  CA  "OUT OF 18"
260 end

Run
```

```
NEW

10 Input "What is your name?" ; N$
20 Print "Good Day.",N$, "Let's do spelling"
30 For H = 1 to 10
40 Print "Read the words"
50 Print "two words are spelled wrong"
60 Print "and one word is correct"
70 Print "type in the word that is correct."
80 Print
90 Read A$,B$,C$,D$
100 Print  "          " A$
110 print
120 Print  "          " B$
130 print
140 Print  "          " C$
150 print
155 Input ANS
156 If ANS<> D$ Goto 170
160 If ANS= D$ then print "Goood,  " N$
165 CA =CA +1
170 If ANS <> D$ then print "No," N$, "It's",D$
171 For T = 1 to 1500
177 Next T
180 Next H
185 print
190 Print "your score was",  CA  "out of 10."
200 Data I"m, am.aam.am
210 Data baod.bod.bed,  bed
220 Data dud.ded.dod,  dud
500 end

Run


NEW

10 INPUT "WHAT IS YOUR NAME?" N$
20 INPUT "WHAT IS YOUR FRIEND'S NAME?" F$
30 PRINT "GOOD DAY", N$,F$
40 READ A$
45 INPUT "TYPE IN YOUR ANSWER", ANS
50 IF ANS =A$ THEN 200 ELSE 150
60 DATA CHURCH,YEAR,SCHOOL,STATE
70 IF ANS=A$ THEN GOTO 150
150 PRINT " THE ANSWER IS", A$
165 GOTO 40
200 PRINT "THAT'S CORRECT, LET YOUR FRIEND DO THE NEXT WORD"
210 GOTO 40
500 END

Run
```

```
NEW
10 print "How many quarters do you have?"
20 input Q
30 Print " how many dimes do you have?"
40 input D
50 Print "How many nickles do you have?"
60 input N
70 Print "How many pennies do you have?"
80 input P
90 Print "what is the total amount of money ?"
100 Print "enter the number of cents."
110 Print "you have"; Q ; "quarters,";D; "Dimes,"
112 Print ; N; "Nickles, and";P; "Pennies."
115 Input A
120 Let T = 25 * Q + 10 * D + 5 * N + P
130 If A=T then 160
140 Print "count Again.  You should have a Total of "; T; "cents."
150 goto 170
160 Print "that's correct."
170 end
Run
```

```
NEW
10 Print "ENTER DEGREES CELSIUS"
20 INPUT C
30 F=(9/5)*C+32
40 PRINT "THE TEMP. IS"; F; "DEGREES F"
50 end
Run
```

```
NEW
10 Read A,B
20 If A=B Then Goto 60
30 IF A  B THEN GOTO 80
40 PRINT A ">" B
50 GOTO 10
60 PRINT A "="B
70 GOTO 10
80 PRINT A "<" B
90 GOTO 10
100 Data 6,3,-2,7,-7,-10,7,7,6,4,15,25,125,345
110 end
Run
```

```
NEW
10 Read L,W
20 P=2*L+2*W
30 PRINT "THE PERIMETER IS";P; "UNITS"
40 Data 7,6
50 end

Run
```

```
NEW
10 PRINT "ENTER LENGTH AND WIDTH"
20 INPUT L,W
30 P= 2*L+2*W
40 PRINT "THE PERIMETER IS";P; "UNITS"
50 END

Run
```

```
NEW
10 READ L,W,H
20 V= L*W*H
30 PRINT "VOLUME IS";V; "CUBIC UNITS"
40 DATA 12,6.6,3.2
50 end

Run
```

```
NEW
10 PRINT "ENTER the LENGTH.WIDTH, AND HEIGHT"
20 INPUT L,W,H
30 V= L*W*H
40 PRINT "THE VOLUME IS";V; "CUBIC UNITS"
50 end

Run
```

```
NEW
10 N=0
20 FOR K = 1 TO 12
30 LET N = N+K
40 PRINT N
50 NEXT K
60 END

Run
```

```
NEW
10 N=0
20 FOR K = 1 TO 12
30 LET N = N*K
40 PRINT N
50 NEXT K
60 END

Run
```

Appendix H

Off-Computer Activities

Appendix H

Off-Computer Activities

The following activities illustrate the importance of complet step-by-step directions. Activities can be complete with an entire group of students or with small groups of students.

1. Have each student write directions for making a peanut butter and jelly sandwich. Then make sandwiches by following one student's directions exactly. Did student mention to open jar of peanut butter?

2. Have students write up directions for an activity than can be done in front of a group of students such as tying a shoe, or making a paper plane. Have students exchange directions with a partner and take turns attempting to follow the partner's directions exactly.

3. Working cooperatively in small groups, students construct step-by-step instructions that a robot would follow. Working within the limited vocabulary of a machine, student's would take turns programming the robot and being the robot.

4. Working cooepratively in small groups, students use Venns diagrams to show and, or, and not conditions.

5. Demonstrate how to make crossword puzzles. Have students make their own crossword puzzles.

6. Have students create rectangles on 1-cm^2 graph paper or geo boards. Have students find the area and perimeter of each rectangle.

7. Have students write their own problems that can be solved by guess and check. Exchange problems and have other students solve them.

8. Have students write number patterns and number sequence examples. Exchange these patterns and sequence examples with a partner and solve.

9. Have students read and write reports about people who are responsible for the computer evolution. Blaise Pascal, Seymour Papert, Grace Hopper.

10. Have students cut out pictures of computers from newspapers and magazines. Have students identify and label each computer part: keyboard, monitor, disk drive, printer.

11. Invite guest speakers--male, female, and minority--from various occupations to your class to discuss how they use computers.

12. Have students cut out pictures from magazine or newspapers of people--male, female, minority--using computers in their work. Then have students write and report on how computers are used.

13. Plan a field trip to a computerized office, business, retail store. Encourage students to question personnel concerning computer application.

Appendix I

DEMOGRAPHIC TABLES

Table 1

Enrollment by Race each October 1

Year	Total	White	Black	Spanish	% White	% Black	% Spanish
1969	31506	23409	6694	1403	74.3	21.3	4.4
1970	31216	22368	7020	1828	71.6	22.5	5.9
1971	30844	21424	7339	2081	69.5	23.8	6.7
1972	30433	20535	7540	2358	67.5	24.8	7.7
1973	29628	19220	7603	2805	64.9	25.6	9.5
1974	28767	17946	7553	3268	62.4	26.2	11.4
1975	28839	17327	7668	3844	60.1	26.6	13.3
1976	28292	16659	7703	3930	58.9	27.2	13.9
1977	28032	15826	7893	4313	56.5	28.1	15.4
1978	26775	14590	7705	4480	54.4	28.9	16.7
1979	25519	13601	7258	4660	53.3	28.4	18.3
1980	24706	12545	7175	4986	50.8	29.0	20.2
1981	23581	11718	6927	4936	49.7	29.4	20.9
1982	23125	10973	6890	5262	47.5	29.8	22.7
1983	22907	10464	6873	5570	45.7	30.0	24.3
1984	22773	10327	6653	5793	45.4	29.2	25.4
1985	22686	10108	6702	5876	44.6	29.5	25.9
1986	22677	10044	6556	6077	44.3	28.9	26.8

Table 2

Enrollment by Race and Ethnicity on October 1
for Brightwood and DeBerry

Year	Brightwood				DeBerry			
	White	Percent	Non-White	Percent	White	Percent	Non-White	Percent.
1977	76	(13.8)	472	(86.2)	109	(28.9)	267	(71.1)
1978	65	(12.9)	436	87.1	114	(29.5)	272	(70.5)
1979	50	(10.3)	432	(89.7)	85	31.0	222	(69.0)
1980	53	(10.9)	433	(89.1)	81	(25.3)	239	(74.7)
1981	53	(12.3)	266	(87.7)	77	(25.2)	228	(74.8)
1982	33	(8.7)	343	(91.3)	83	(28.9)	268	(71.1)
1983	41	(9.7)	380	(90.3)	78	(21.2)	298	(78.8)
1984	64	(15.1)	358	(84.9)	67	(16.8)	334	(83.2)
1985	94	(20.6)	199	(79.4)	79	(19.3)	331	(80.7)
1986	96	(19.8)	389	(80.2)	124	(29.0)	303	(71.0)

Table 3

Percent of Female by School on October 1

Year	Brightwood			DeBerry			System		
	Female	Percent	Total	Female	Percent	Total	Female	Percent	Total
1984	208	49.3	422	200	50.3	398	10736	47.2	22746
1985	201	44.0	457	195	47.6	410	10650	46.9	22686
1986	223	46.0	485	204	47.8	427	10650	47.8	22677